720-051-7431-A

PREPARE A PLUMBING TAKEOFF LIST
PHASE II
ELBOWS, TEES AND FAUCETS

TEC LESSON 720-051-7431-A

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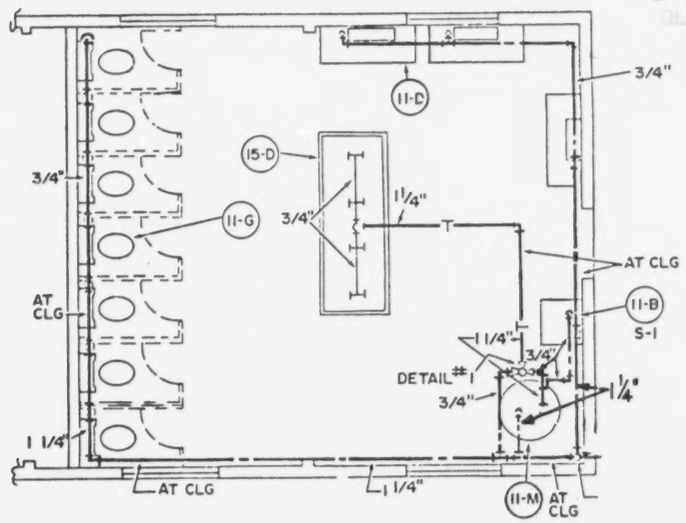

PRODUCED BY
US ARMY ENGINEER SCHOOL
FORT BELVOIR, VIRGINIA 22060

STUDENT/SUPERVISOR INSTRUCTIONS, PRE-TEST/POST-TEST, AND ANSWER KEY ARE CONTAINED IN THIS BOOK

REVISED

READ THE STUDENT/SUPERVISOR INSTRUCTIONS CAREFULLY. BE SURE YOU UNDERSTAND THEM COMPLETELY BEFORE BEGINNING THE LESSON. PLEASE DO NOT WRITE IN THIS BOOK.

The words "he," "his," and "men," when used in this publication, represent both the masculine and feminine genders, unless otherwise specifically stated.

STUDENT/SUPERVISOR INSTRUCTIONS

TYPE OF LESSON

- Plumbing Materials

AUDIENCE

- 51K Plumber
- Applicable to all Skill Level 10 and 20 soldiers

TRAINING OBJECTIVES

- Soldiers completing this lesson should be able to determine the number of elbows, tees and faucets required for a plumbing project.

MATERIAL/EQUIPMENT/PERSONNEL REQUIRED

- Lesson book
- Pencil or pen
- Paper

TIME REQUIRED

- Individual: 50 minutes
- Group: 60 minutes

REFERENCES

- TM 5-551K
- TM 5-704

STUDENT/SUPERVISOR INSTRUCTIONS

STUDENT INSTRUCTIONS

- Prerequisites: Before taking this lesson, you should have successfully completed TEC Lesson 720-051-7430-A.
- Take the Pretest/Posttest. If you pass, you do not have to take the lesson.
- Make sure you have the material, equipment, and personnel required to complete the lesson.
- Take the lesson. Use a separate sheet of paper for the exercises. Do not write in this book.
- When you complete the lesson, take the Pretest/Posttest again. If you do not pass, take the lesson again.

SUPERVISOR INSTRUCTIONS

- Make sure students have completed the prerequisites listed in the Student Instructions.
- Administer the Pretest/Posttest to determine need for the lesson. Responses to test questions must be made on a separate sheet of paper, not in the lesson book. To pass the test, a soldier must answer 8 of the 10 test items correctly.
- Make sure students have the material, equipment, and personnel required to complete the lesson.
- Administer the lesson to students who do not pass the Pretest/Posttest. Remind them to write their responses to the exercises on a separate sheet of paper and not in the lesson book.
- Administer the Pretest/Posttest to students who complete the lesson. Students who do not pass must take the lesson again.

TEC LESSON 720-051-7431-A

PREPARE A PLUMBING TAKEOFF LIST
PHASE II: ELBOWS, TEES, AND FAUCETS

This test consists of 10 questions that cover every training objective of the lesson. These questions have a total value of 100 points. When you have completed the test, check your answers against the Pretest/Posttest Answer Key on page 76 . If you do not score at least 80 points, you must take the lesson. Write your responses on a separate sheet of paper. Do not write in this book.

INSTRUCTIONS: Using the blueprint illustrations shown on pages 5 through 8, study Figures 1 through 7 and answer the questions on pages 3 and 4.

1. How many 3/4" ELBOWS are needed for the cold water line from point (A) to ALL the URINAL FLUSH TANKS? (Figures 1 and 3)
   a. 4
   b. 5
   c. 6
   d. 7

2. How many ELBOWS by SIZE are needed to connect the cold water line at ALL the WATER CLOSET FLUSH TANKS? (Figures 1 and 4)

   SIZE _____ NUMBER _____

3. How many ELBOWS by SIZE are needed for the tempered (T) water line from point (B) to the BATHHOUSE WASH BENCH? (Figures 1 through 5)

   SIZE _____ NUMBER _____

4. How many ELBOWS by SIZE are needed for the ENTIRE WATER PIPE PLUMBING SYSTEM? (Figures 1 through 7)

   SIZE _____ NUMBER _____

5. How many 1 1/4" x 3/4" TEES are needed for cold water service from point Ⓒ to the WATER CLOSET FLUSH TANKS? (Figures 1 and 4)

a. 1
b. 2
c. 3
d. 4

6. How many TEES by SIZE are needed for complete cold water service from point Ⓒ to ALL the WATER CLOSET FLUSH TANKS? (Figures 1 and 4)

SIZE	NUMBER

7. How many TEES by TYPE and SIZE are needed for Tempered (T) water service from point Ⓓ to the BATHHOUSE WASH BENCH? (Figures 1 and 5)

TYPE	SIZE	NUMBER

8. How many TEES by SIZE are needed for the cold water line from point Ⓐ (INCLUDE POINT Ⓐ) to the URINALS? (Figures 1 and 3)

SIZE	NUMBER

9. How many TEES by SIZE are needed for the ENTIRE WATER PIPE PLUMBING SYSTEM? (Figures 1, 3 and 5)

SIZE	NUMBER

10. How many FAUCETS BY SIZE are needed for the complete plumbing system? (Figures 1, 2 and 5)

a. SINGLE SINK _____
b. BATHHOUSE WASH BENCH _____

PREPARE A PLUMBING TAKEOFF LIST

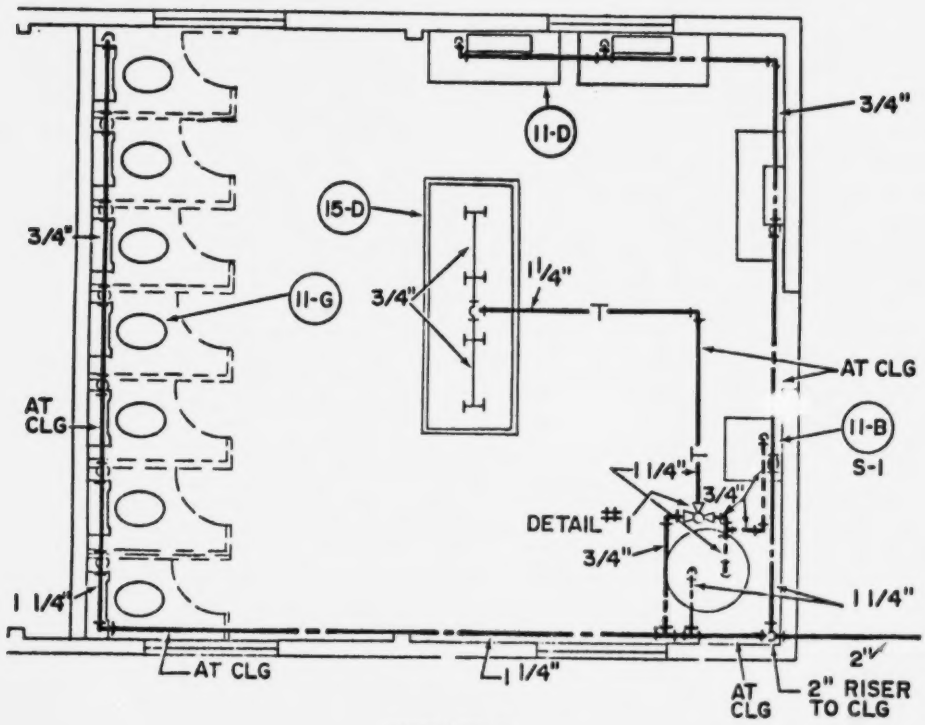

FIGURE 1

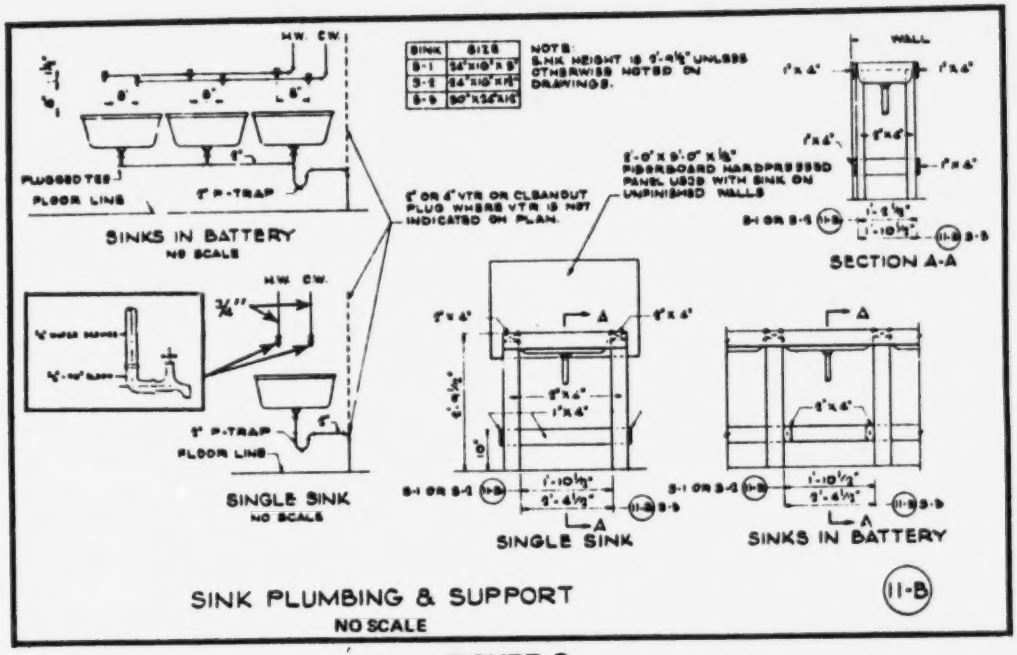

FIGURE 2

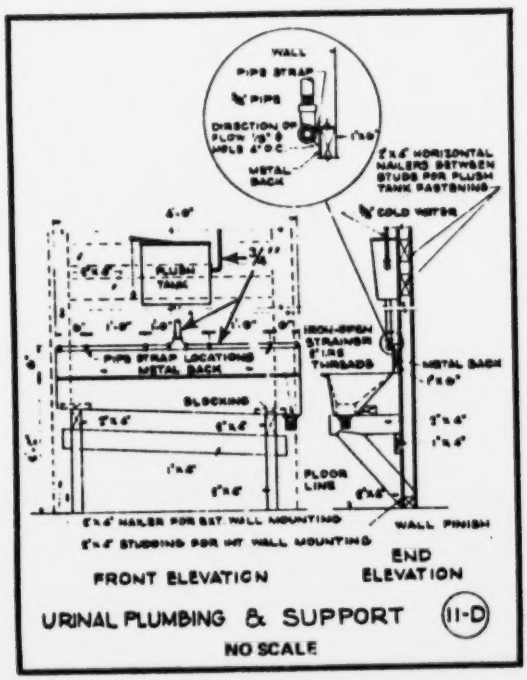

FIGURE 3

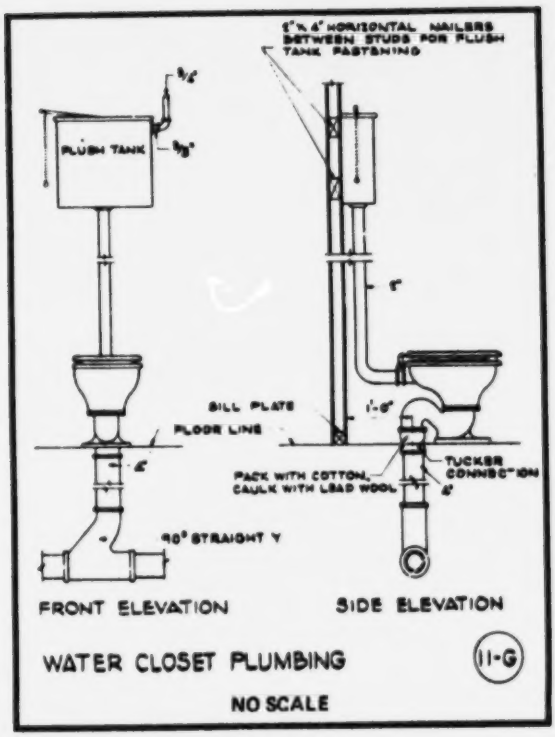

FIGURE 4

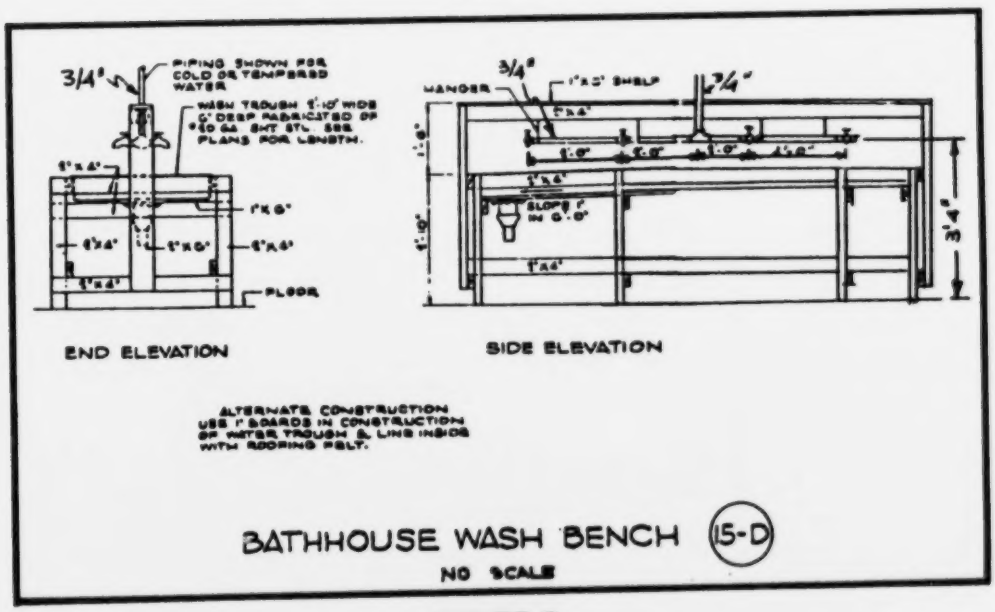

FIGURE 5

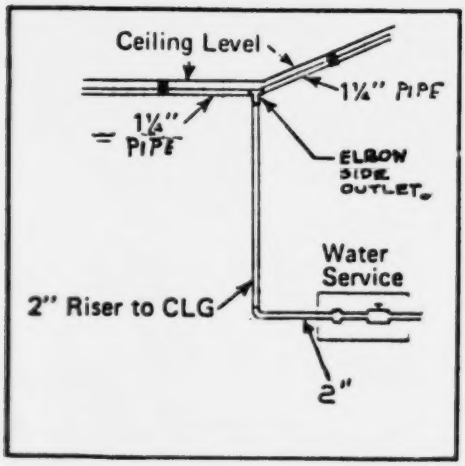

FIGURE 6

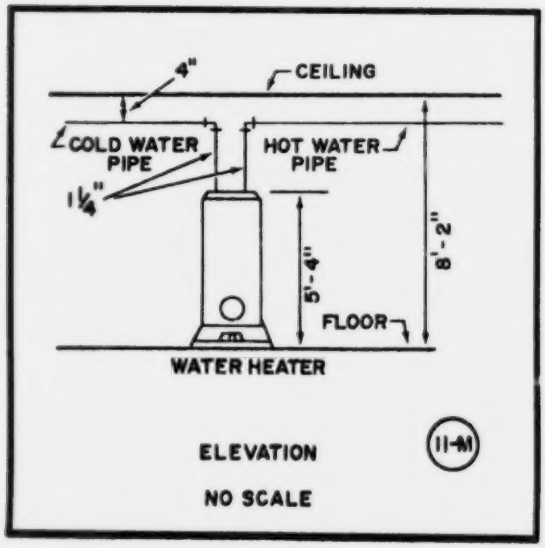

FIGURE 7

INTRODUCTION

A bill of material is a list of all the materials needed to construct a building. Carpenters, electricians, and plumbers are often required to put together a list of materials for their part of a job. As a 51K10, you will be required to prepare a list of materials for a plumbing system and/or a section of the plumbing system. The key to determining a list of materials is the ability to interpret the information on a blueprint or set of blueprints.

A bill of material is broken down into two phases called a TAKEOFF and an ESTIMATE.

A TAKEOFF is the actual count and checkoff of materials that are shown or specified on a blueprint or a set of blueprints. In other words, it's what you can see on blueprints and reference number fixture breakouts.

An ESTIMATE is the materials needed but not shown or specified on a blueprint or a set of blueprints, such as nails, pipe joint compound, oakum, lead, and pipe hangers. In other words, it's what you can't see on the blueprints.

The TAKEOFF and the ESTIMATE are combined to form a complete fill of material for any plumbing system.

This instructional package is the second in a series of four lessons. It will cover how to obtain a TAKEOFF list of materials.

When you have completed all four instructional lessons in this package, you will be able to determine materials for a plumbing project.

PHASE II

INSTRUCTIONS

This instructional series consists of five lessons. This is the second in the series on how to obtain a plumbing takeoff list.

You will be given simple blueprints with symbols, abbreviations, reference number breakout for fixtures, and a self-test.

You will go at your own pace, DO NOT HURRY. Read the information, look over the blueprints and breakouts, and then extract the plumbing information.

After you complete this phase to your satisfaction, ask your administrator to give you the post-test for this phase. When you complete the lesson satisfactorily, you can start on the next lesson.

1. DETERMINE THE NUMBER OF PIPE FITTINGS BY TYPE AND SIZE–ELBOWS

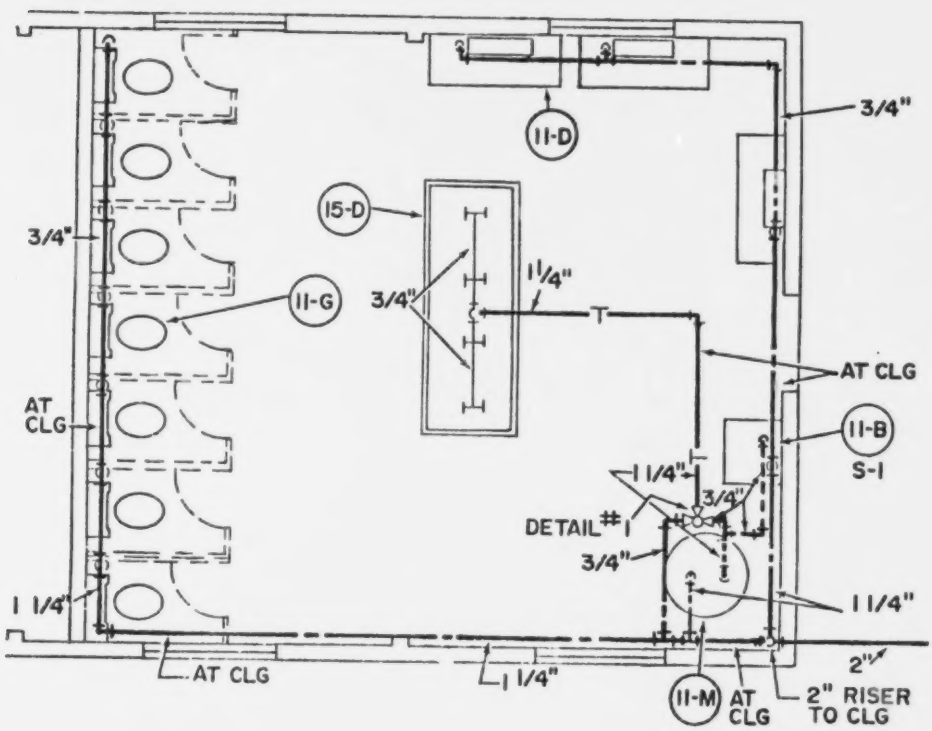

FIGURE 1

a. A plumbing water system uses many types and sizes of pipe fittings to control the direction of water flow. This is necessary to get the desired hot or cold water through the system to the fixtures. As a plumbing specialist, you will have to make a list of material for the plumbing water system. This will include such fittings as elbows, tees, and faucets. To do this, you will need a blueprint (Figure 1) and the reference numbered breakout for the fixtures that are shown on the blueprint. The fixture reference numbered breakouts (Figures 2 through 6) are shown on the following pages.

b. To determine the NUMBER of water pipe ELBOWS, by SIZE, you need the blueprint (Figure 1) and the reference numbered breakouts (Figures 2 through 6).

(1) First find the number of ELBOWS by SIZE from the blueprint and each fixture reference numbered breakout.

(2) Then add up ALL THE ELBOWS by SIZE for the plumbing water system.

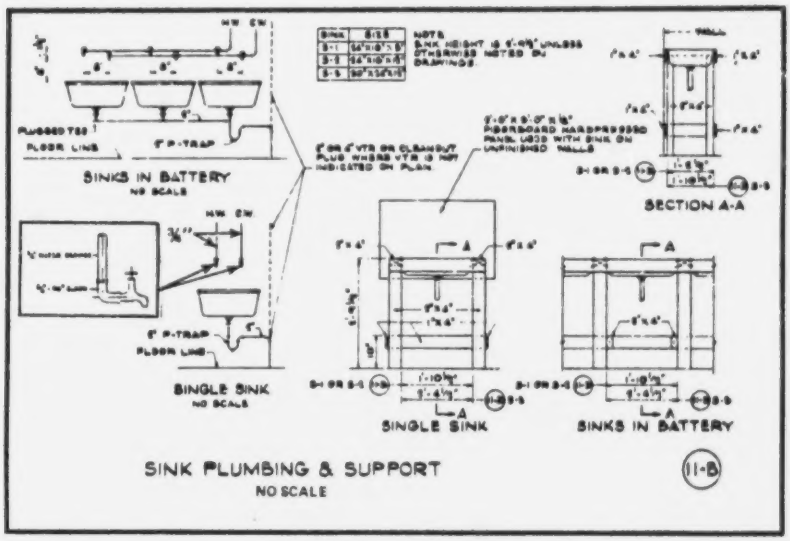

FIGURE 2

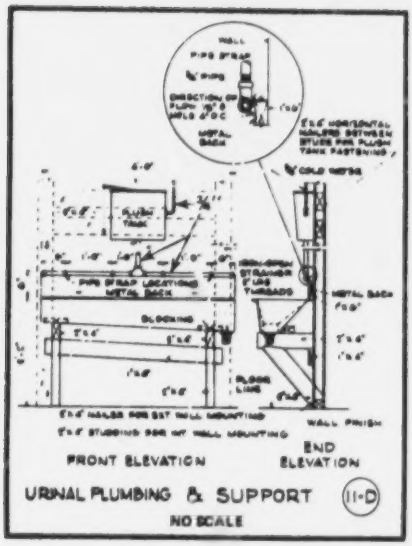

FIGURE 3

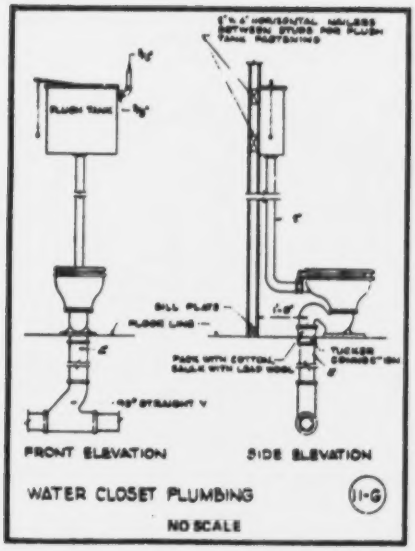

FIGURE 4

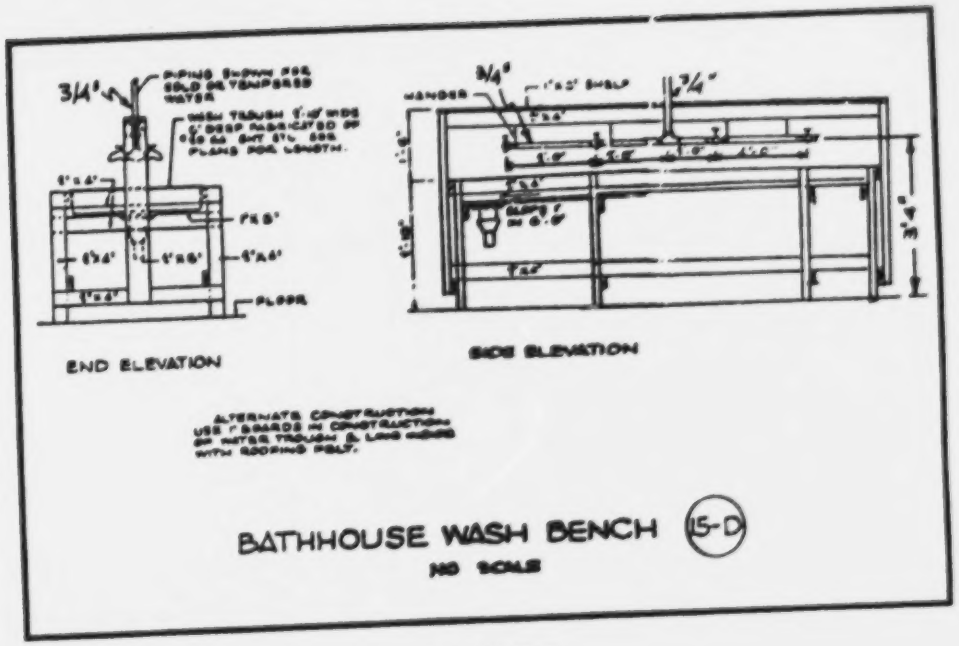

FIGURE 5

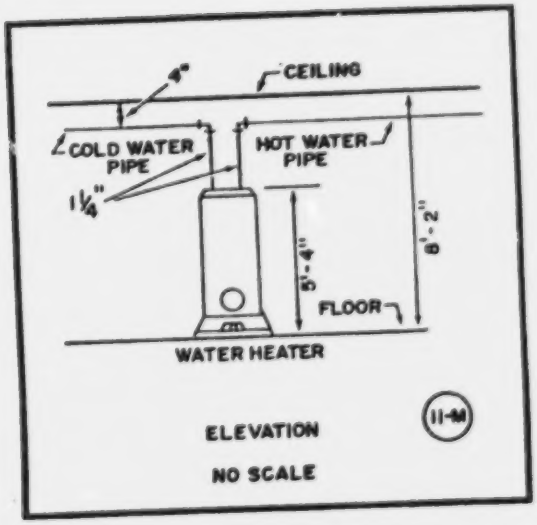

FIGURE 6

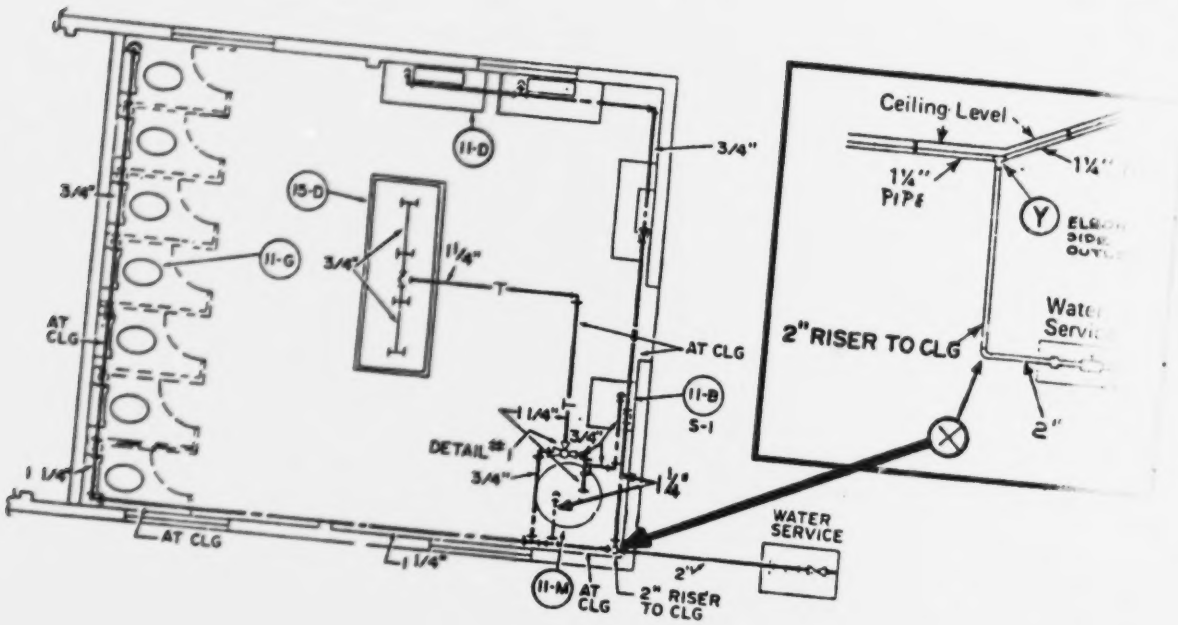

FIGURE 7

c. Starting at the water service, the 2" water pipe enters the building at ground le... The 2" water pipe then changes its direction, going up to the ceiling (Figure 7), wit... 2" ELBOW at point (X). So ONE 2" ELBOW is needed. At point (Y) an ELB... called ELBOW, SIDE OUTLET changes the direction for two water pipe lines. ... SIZE of this ELBOW is 2" x 1¼" x 1½". The ELBOWS needed at the water ser... entrance are:

SIZE	NUMBER
2" Elbow	1
2" x 1¼" x 1¼" Elbow, Side Outlet	1

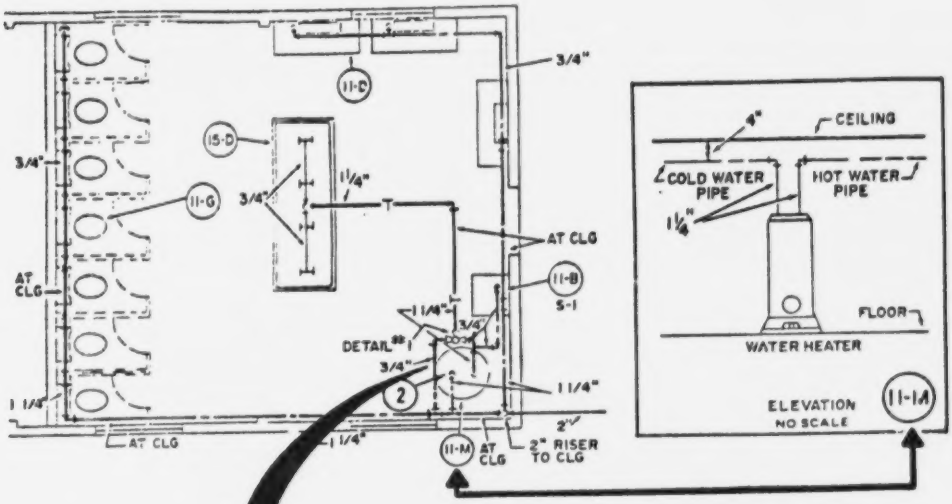

FIGURE 8

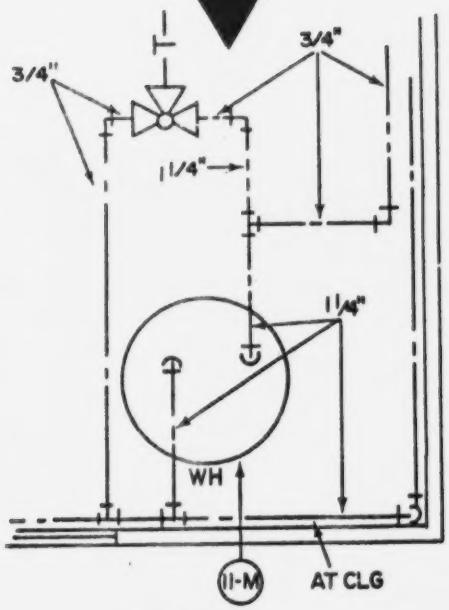

FIGURE 8A

(3) You can now ADD up all the ELBOWS by SIZE.

SIZE	NUMBER
1¼" ELBOWS	2
1¼" x 3/4" ELBOWS	1
3/4" ELBOW	2

d. The NUMBER of ELBOWS needed by SIZE for the water pipes going to and from the WATER HEATER are shown on the blueprint and the WATER HEATER reference numbered breakout (11-M) (Figure 8). To get a better view of the WATER HEATER area, a blowup of that area (Figure 8A) is used.

(1) You will see circles with the numbers (Figure 8A). Each numbered circle shows an ELBOW whose SIZE can be figured out by the pipe size to and from the ELBOW.

(2) The ELBOW SIZES are:

① 1¼" ELBOW, TURNED DOWN TO WATER HEATER

② !¼" ELBOW, TURNED DOWN TO WATER HEATER

③ 3/4" ELBOW

④ 1¼" x 3/4" ELBOW

⑤ 3/4" ELBOW

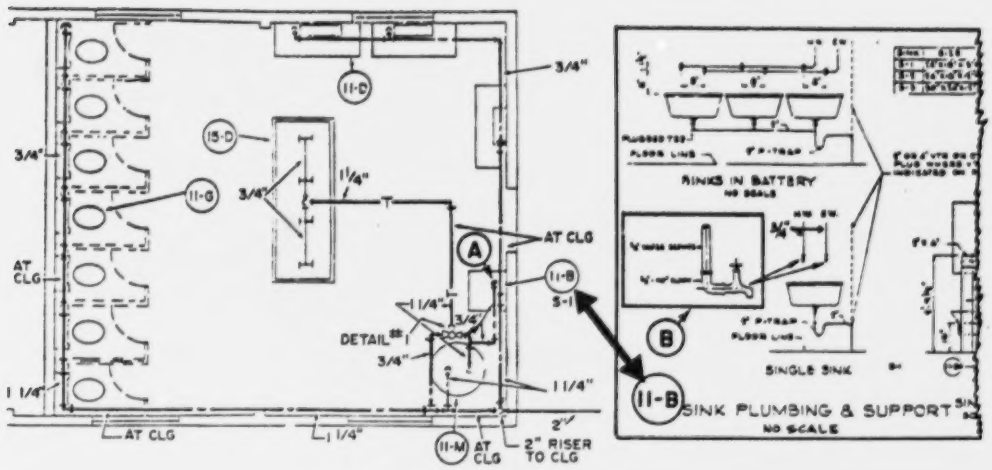

FIGURE 9

e. The blueprint and a part of the sink breakout (11-B) (Figure 9) shows an ELBOW, TURNED DOWN at point (A) and a 3/4" 90° ELBOW for each of the hot water (HW) and cold water (CW) faucets at point (B) . The ELBOW, TURNED DOWN is 3/4" because the pipe going to and from the ELBOW is 3/4". The ELBOWS needed for the faucets at point (B) are 3/4" as shown on a part of the sink breakout (11-B) Therefore the NUMBER OF ELBOWS needed by SIZE is:

SIZE	NUMBER
3/4"	3

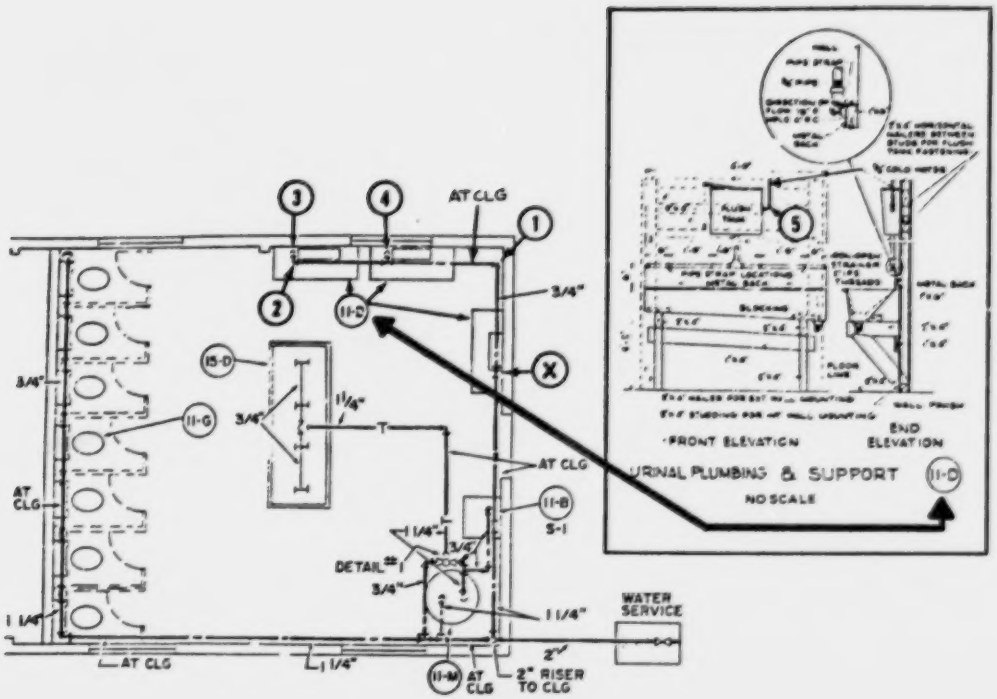

FIGURE 10

f. To find the NUMBER OF ELBOWS needed by SIZE for cold water service to the urinal flush tanks, you have to find the size of the pipe to and from the ELBOWS. As you can see, the pipe size changes from 1¼" to 3/4" at point (X) (Figure 10) and the pipe going down to the flush tank is 3/4" as shown in the breakout (11-D) (Figure 10). You see circles with numbers that pinpoint the ELBOWS that are needed by SIZE. The TOTAL ELBOWS needed by SIZE are:

①	ONE (1)	3/4" ELBOW
②	ONE (1)	3/4" ELBOW
③	ONE (1)	3/4" ELBOW, TURNED DOWN
④	ONE (1)	3/4" ELBOW, TURNED DOWN
⑤	THREE (3)	3/4" ELBOWS (Three urinals each with a flush tank)
TOTAL	SEVEN (7)	3/4" ELBOWS (Needed for water service to all urinals).

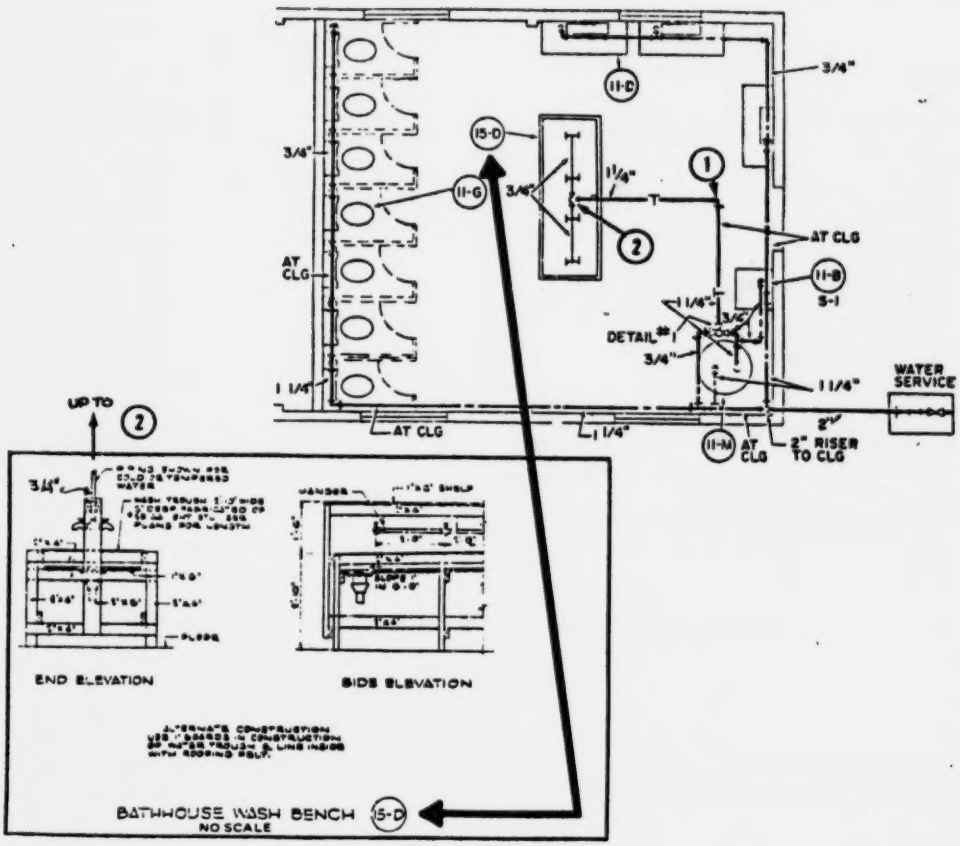

FIGURE 11

g. Starting at DETAIL #1 (Figure 11) and following the 1¼" tempered water pipe line to point (1) where an ELBOW is used to change the direction of the 1¼" pipe toward the Bathhouse Wash Bench. So ONE (1) 1¼" ELBOW is needed at point (1). The pipe coming into the ELBOW, TURNED DOWN, at point (2) is 1¼"" but the pipe size leaving the ELBOW, TURNED DOWN, is 3/4" as shown in breakout (15-D). Therefore the ELBOW SIZE at point (2) is 1¼" x 3/4" and only ONE (1) is needed. The ELBOW SIZES needed are:

SIZE	NUMBER
1¼"	1
1¼" x 3/4"	1

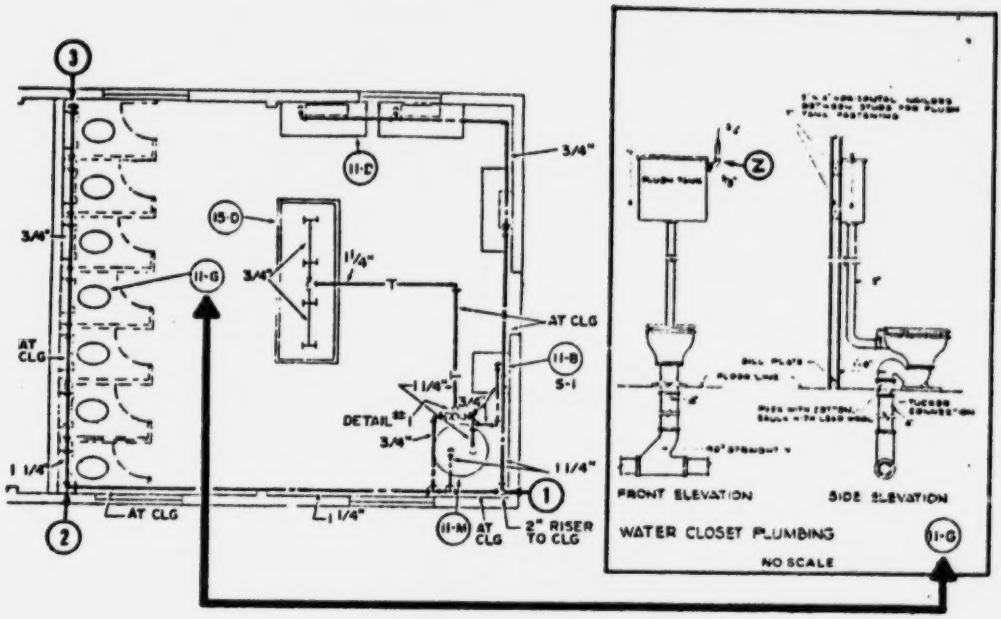

FIGURE 12

h. To find the ELBOWS needed by SIZE for cold water service to the water closet flush tanks, it is best to start from point (1) (Figure 12).

(1) Go to the left from point (1) along the 1¼" cold water pipe line to the ELBOW at point (2) (Figure 12). The pipe size going into the ELBOW is 1¼" and leaving the ELBOW is 1¼". So at point (2) you have ONE (1) 1¼" ELBOW.

(2) Looking at the water closet breakout (11-G) at point (Z) (Figure 12), a 3/4" pipe comes into the ELBOW and a 3/8" pipe leave the ELBOW. Therefore the ELBOW needed by SIZE is 3/4" x 3/8" for each flush tank. Since each of the SEVEN water closets' flush tanks need a 3/4" x 3/8" ELBOW, the TOTAL 3/4" x 3/8" ELBOWS needed is SEVEN (7).

(3) Point (3) shows an ELBOW, TURNED DOWN (Figure 12) for cold water service to the flush tank for that end water closet. The water pipe going into the ELBOW is 3/4" and the water pipe size coming down to the flush tank is 3/4" (WATER CLOSET BREAKOUT, FIGURE 12). So at point (3) ONE (1) 3/4" ELBOW is needed.

(4) The TOTAL ELBOWS by SIZE needed for cold water service to the water closet FLUSH TANKS are:

SIZE	NUMBER
1¼" ELBOW AT ②	1
3/4" x 3/8" ELBOW FOR EACH FLUSH TANK AT ②	7
3/4" ELBOW, TURNED DOWN AT ③	1

i. To get the TOTAL ELBOWS needed by SIZE for the plumbing water system, make a list of them, then add them up by SIZE.

		SIZE	NUMBER
(1)	ELBOWS AT WATER SERVICE ENTRANCE	2"	1
		2"x1¼"x1¼"	1
(2)	ELBOWS AT THE WATER HEATER	1¼"	2
		3/4"	2
		1¼"x3/4"	2
(3)	ELBOWS AT THE SINGLE SINK	3/4"	3
(4)	ELBOWS AT THE URINALS	3/4"	7
(5)	ELBOWS AT THE WASH BENCH	1¼"	1
		1¼"x3/4"	1
(6)	ELBOWS AT THE WATER CLOSETS	1¼"	1
		3/4"x3/8"	7
		3/4"	1

(7) THE TOTAL ELBOWS NEEDED BY SIZE ARE:

SIZE	NUMBER
2"	1
2"x1¼"x1¼"	1
1¼"	4
1¼"x3/4"	2
3/4"	13
3/4"x3/8"	7

j. Now turn to the next page and work on the practice exercise. If you have any doubt about how to get the number of elbows needed by size, you should go back and review the information and then turn to the next page and try the practice questions.

PRACTICE EXERCISE

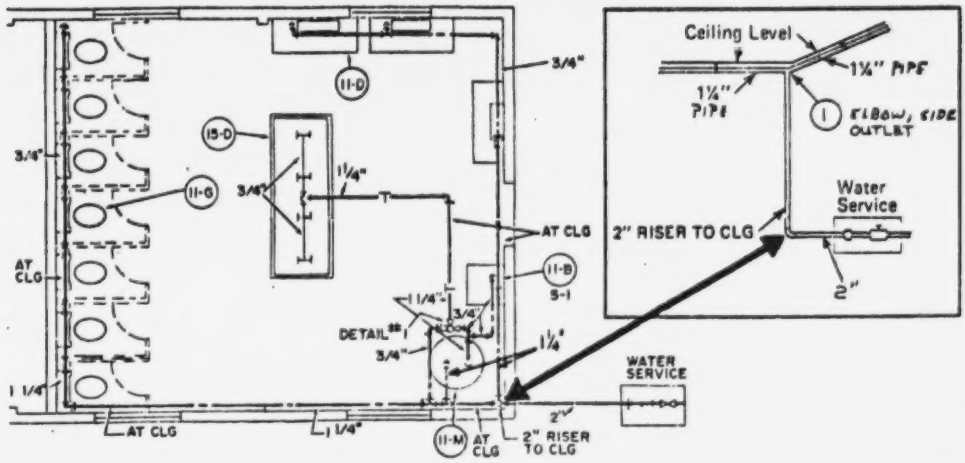

FIGURE 13

(1) How many ELBOWS by SIZE are needed to bring cold water into the building to the 1¼" pipes at the ceiling level? (Figure 13)

SIZE	NUMBER

PRACTICE EXERCISE

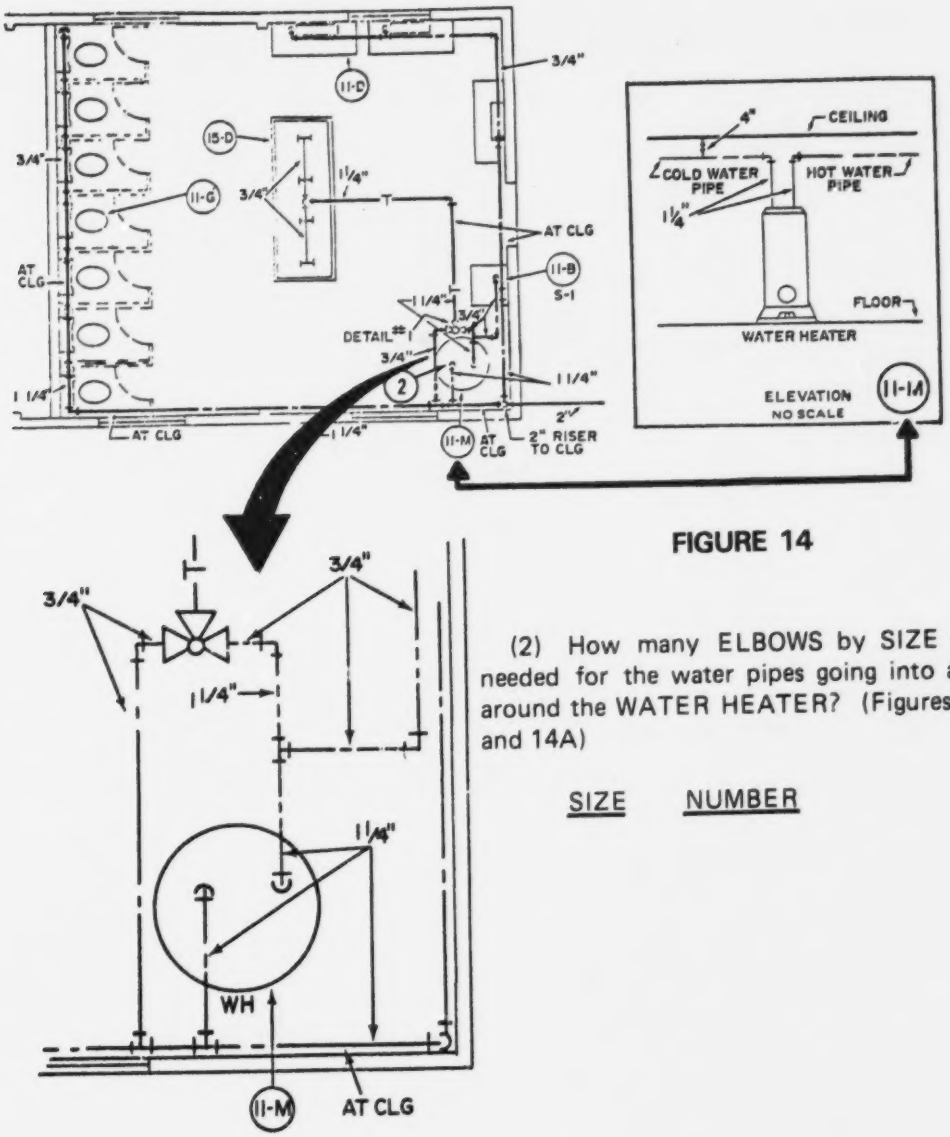

FIGURE 14

(2) How many ELBOWS by SIZE are needed for the water pipes going into and around the WATER HEATER? (Figures 14 and 14A)

SIZE	NUMBER

PRACTICE EXERCISE

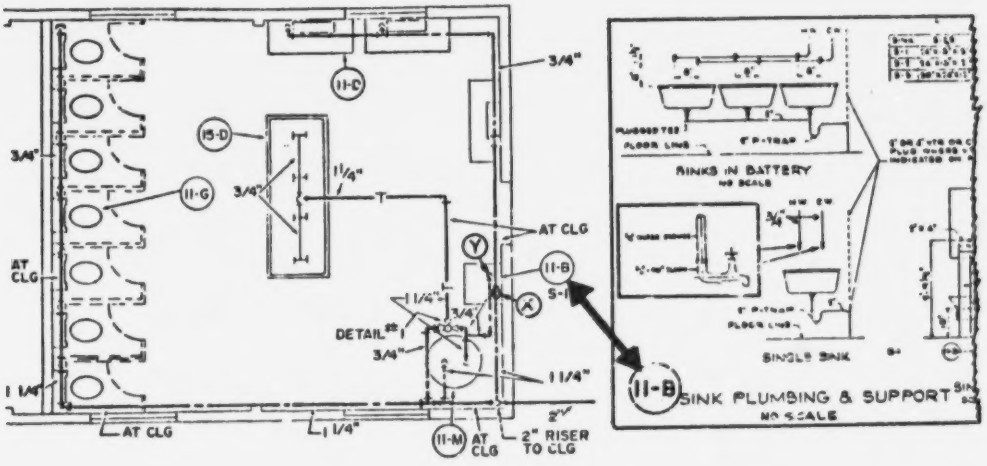

FIGURE 15

(3) How many ELBOWS by SIZE are needed for HOT and COLD WATER service to the SINGLE SINK from points (X) and (Y) ? (Figure 15)

SIZE	NUMBER

PRACTICE EXERCISE

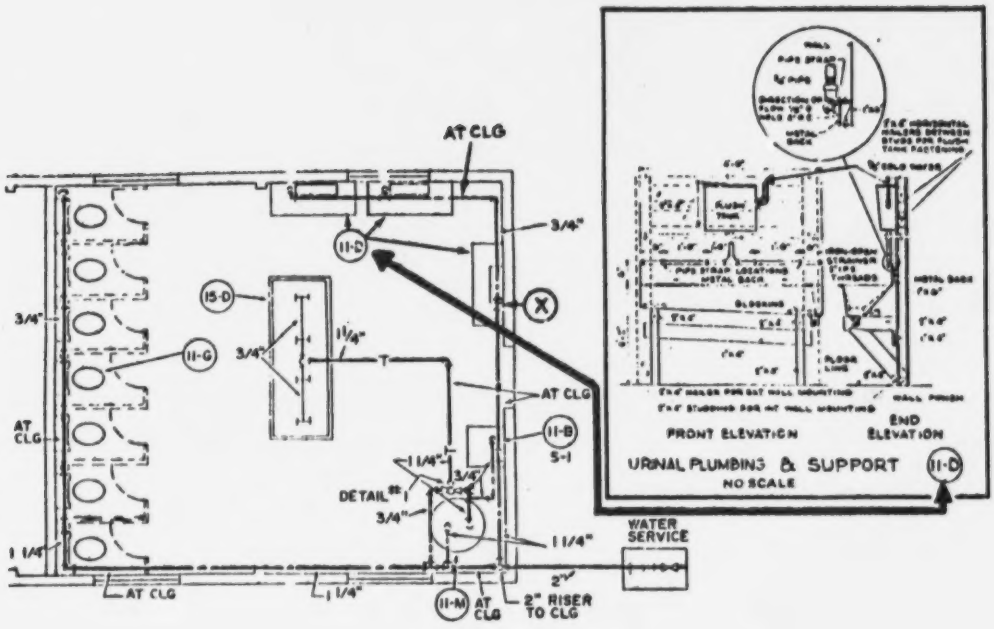

FIGURE 16

(4) How many ELBOWS by SIZE are needed from point (X) for cold water service to ALL the urinals FLUSH TANKS? (Figure 16)

SIZE	NUMBER

PRACTICE EXERCISE

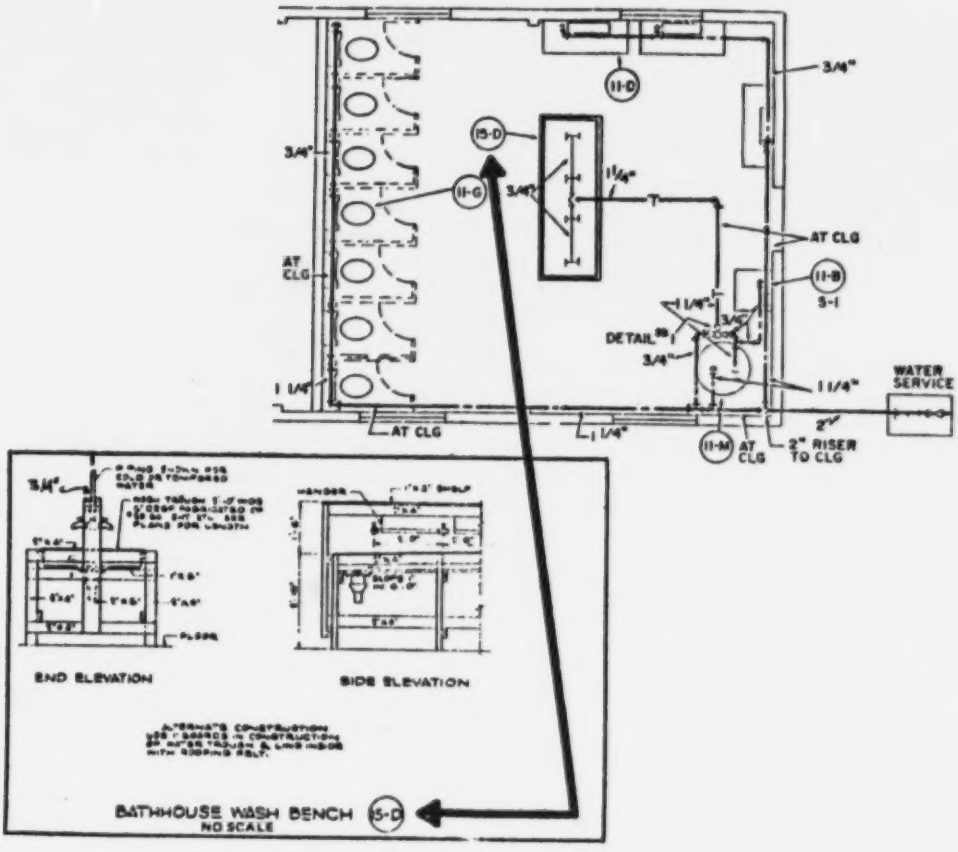

FIGURE 17

(5) How many ELBOWS by SIZE are needed from DETAIL #1 for tempered water service to the bathhouse wash bendh? (Figure 17)

SIZE	NUMBER

PRACTICE EXERCISE

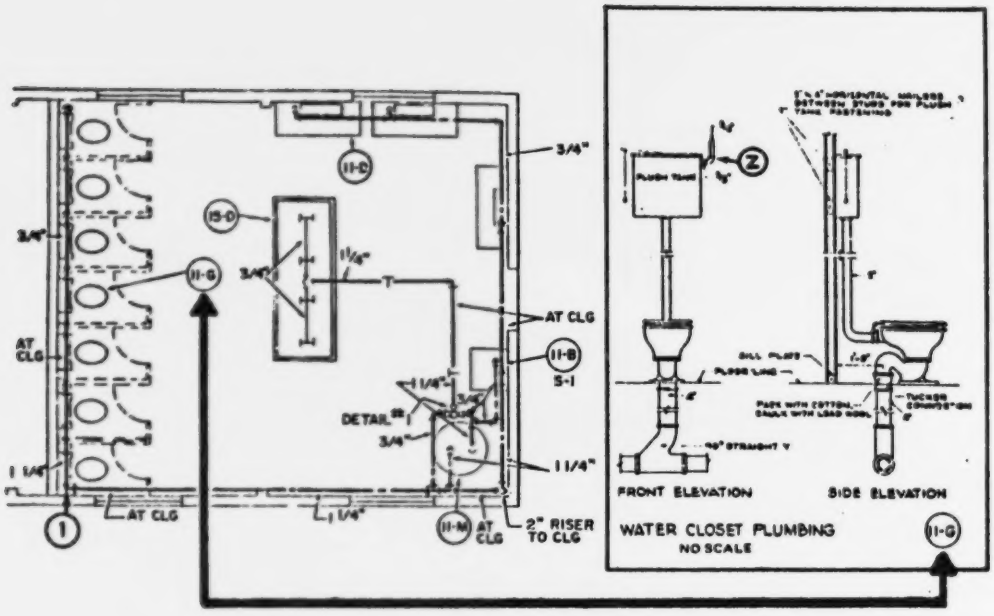

FIGURE 18

(6) How many ELBOWS by SIZE are needed from point ① (include point ①) for cold water service to ALL the water closet FLUSH TANKS? (Figure 18)

SIZE	NUMBER

CHECK YOUR ANSWERS WITH THE SOLUTIONS ON THE FOLLOWING PAGES

SOLUTION

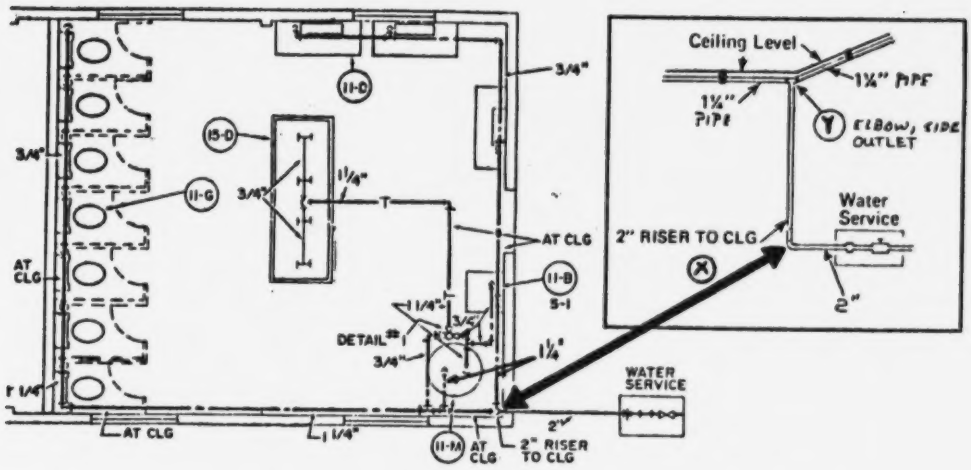

FIGURE 19

1. How many ELBOWS by SIZE are needed to bring cold water into the building to the 1¼" pipes at the ceiling level? (Figure 19)

SIZE	NUMBER	LOCATION
2" ELBOW	1	Ⓧ
2"x1¼"x1¼" ELBOW, SIDE OUTLET	1	Ⓨ

SOLUTION

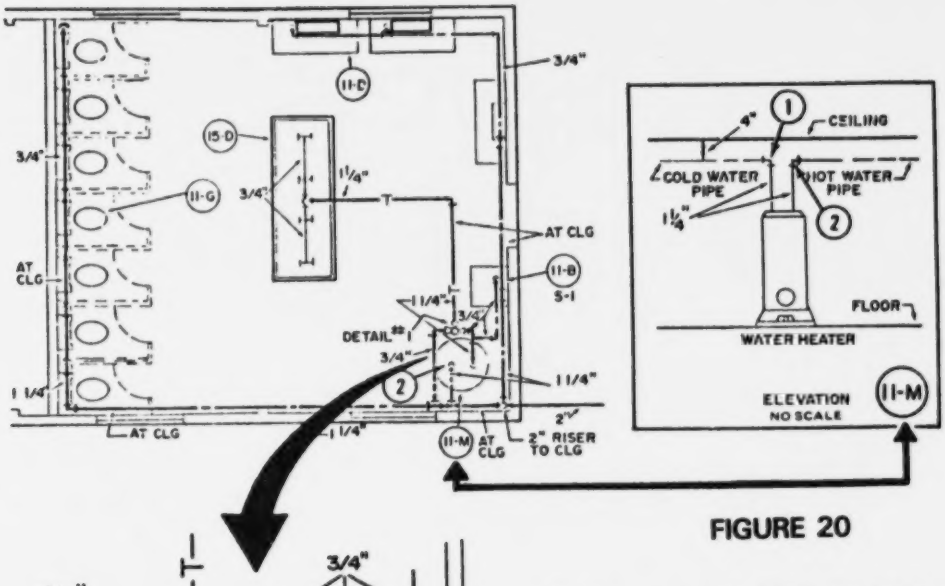

FIGURE 20

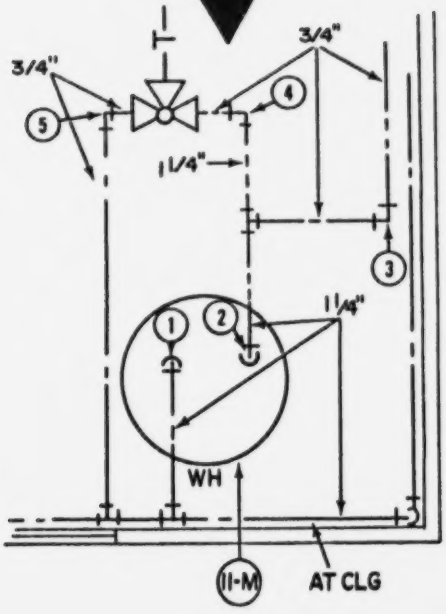

FIGURE 20A

2. How many ELBOWS by SIZE are needed for the water pipes going into and around the WATER HEATER? (Figures 20 and 20A)

SIZE	NUMBER
1¼" ELBOWS	3
1¼"x3/4" ELBOWS	1
3/4" ELBOWS	2

LOCATION OF ELBOW SIZES:

① 1¼" ELBOW, TURNED DOWN to water heater

② 1¼" ELBOW, TURNED DOWN to water heater

③ 3/4" ELBOW

④ 1¼"x3/4" ELBOW

⑤ 3/4" ELBOW

SOLUTION

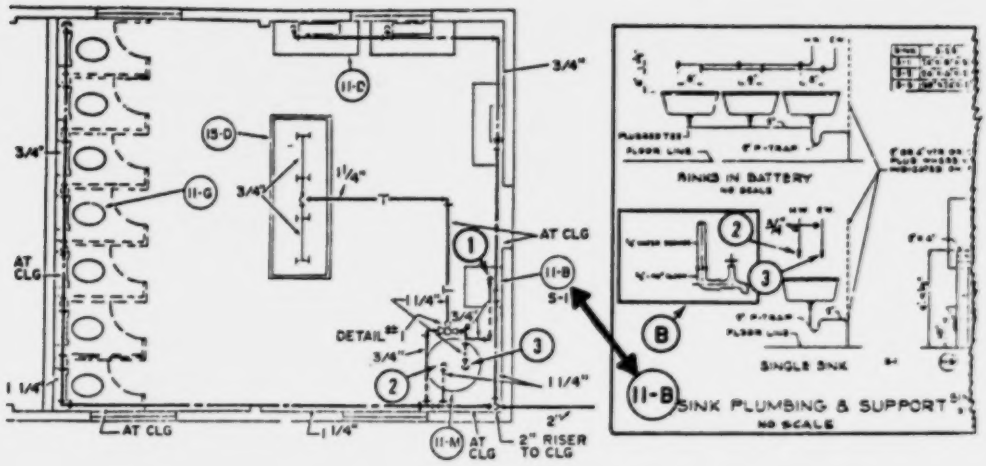

FIGURE 21

3. How Many ELBOWS by SIZE are needed for HOT and COLD water service to the SINGLE SINK? (Figure 21)

SIZE	NUMBER
3/4"	3

LOCATION BY SIZE

① 3/4" ELBOW, TURNED DOWN

② 3/4" ELBOW, FOR HOT WATER (HW) FAUCET

③ 3/4" ELBOW, FOR COLD WATER (CW) FAUCET

SOLUTION

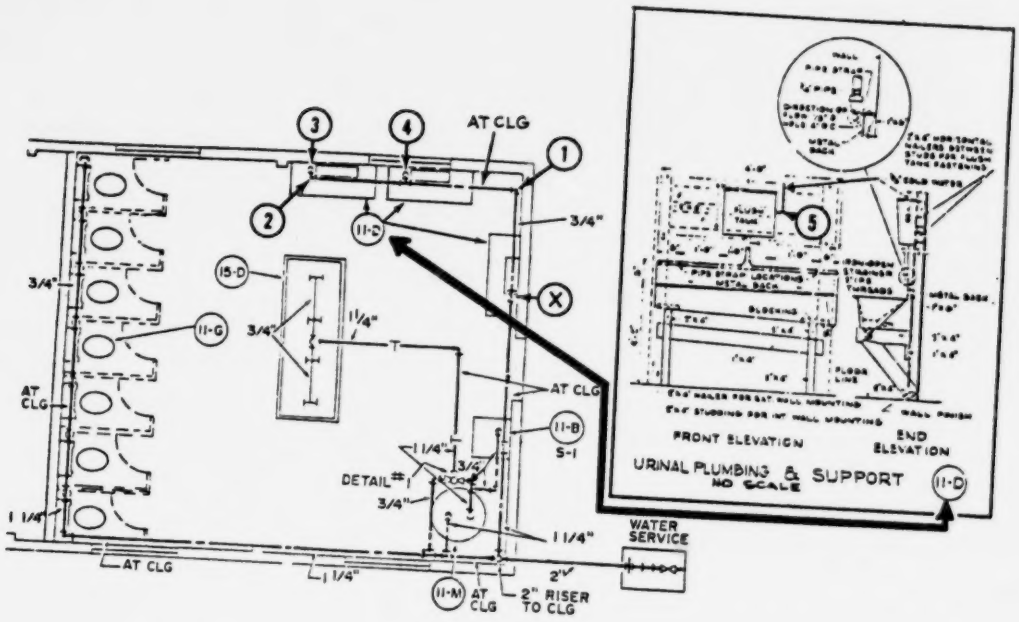

FIGURE 22

4. How many ELBOWS by SIZE are needed from point (X) for cold water service to ALL the urinals FLUSH TANKS? (Figure 22)

SIZE	NUMBER
3/4" ELBOWS	7

LOCATION BY SIZE

① 3/4" ELBOW

② 3/4" ELBOW

③ 3/4" ELBOW, TURNED DOWN

④ 3/4" ELBOW, TURNED DOWN

⑤ 3/4" ELBOW INTO EACH FLUSH TANK FOR THREE URINALS FOR A TOTAL OF THREE 3/4" ELBOWS

SOLUTION

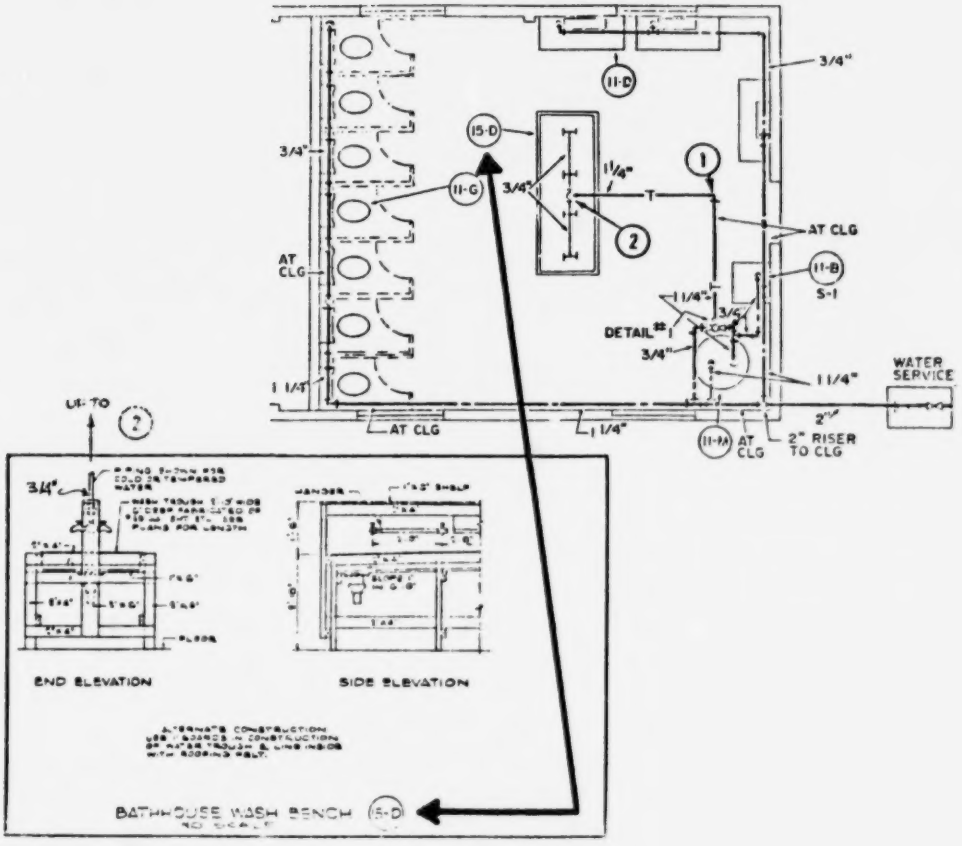

FIGURE 23

5. How many ELBOWS by SIZE are needed from DETAIL #1 for tempered water service to the bathhouse wash bench? (Figure 23)

SIZE	NUMBER
1½" ELBOW	1
1¼"x3/4" ELBOW	1

LOCATION BY SIZE

① 1¼" ELBOW

② 1¼"x3/4" ELBOW, TURNED DOWN

SOLUTION

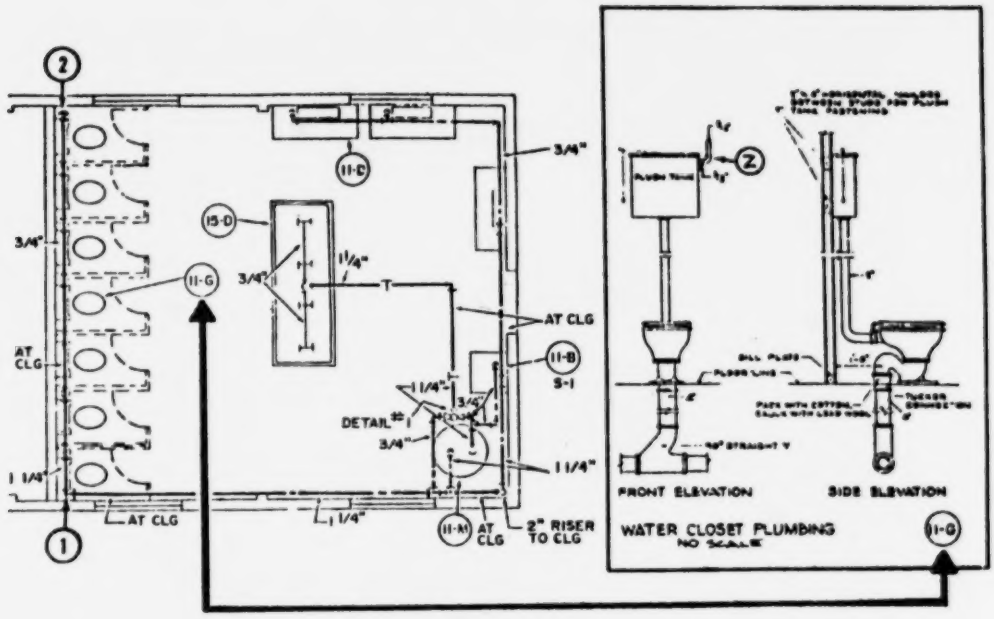

FIGURE 24

6. How many ELBOWS by SIZE are needed from point ① (include point ①) for cold water service to ALL the water closet FLUSH TANKS? (Figure 24)

SIZE	NUMBER
1¼" ELBOW	1
3/4"x3/8" ELBOWS	7
3/4" ELBOW, TURNED DOWN	1

LOCATION BY SIZE

① 1¼" ELBOW

Ⓩ 3/4"x3/8" ELBOW–ONE FOR EACH OF THE FLUSH TANKS FOR SEVEN WATER CLOSETS

② 3/4" ELBOW, TURNED DOWN

2. DETERMINE THE NUMBER OF PIPE FITTINGS BY TYPES AND SIZES–TEES

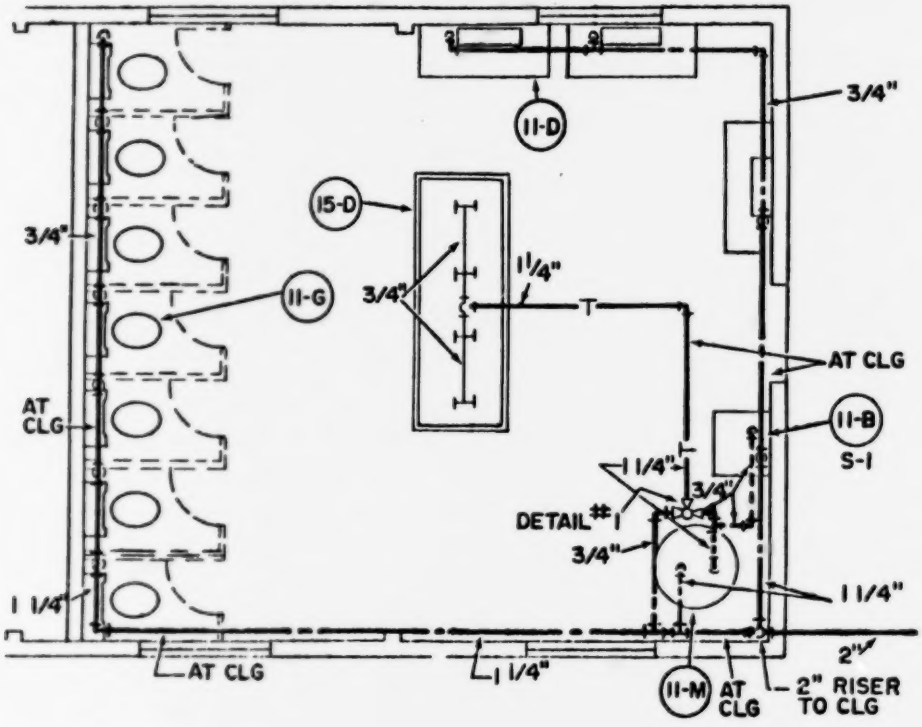

FIGURE 25

a. To determine the NUMBER of water pipe TEES by SIZE, you need a blueprint (Figure 25) and the reference numbered breakouts for the fixture on the blueprint (Figures 26 through 29) shown on the following pages.

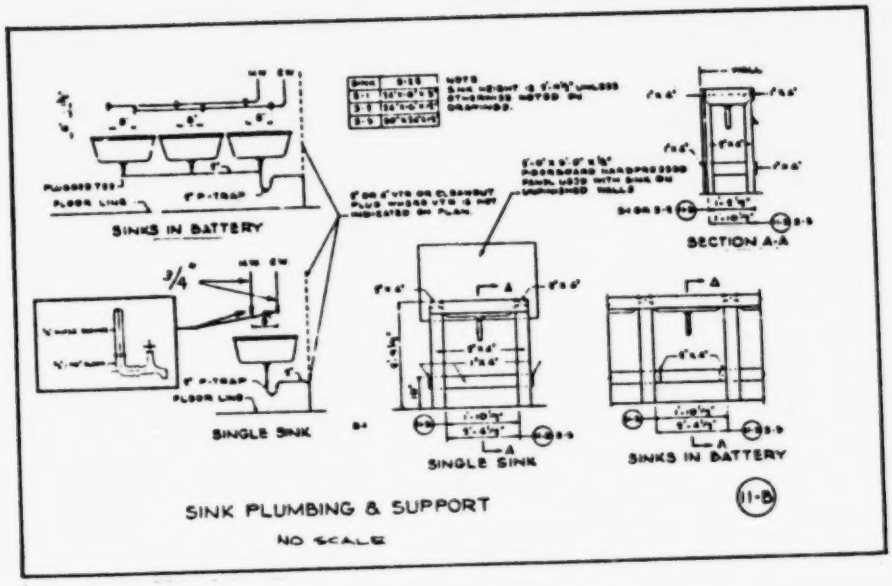

FIGURE 26

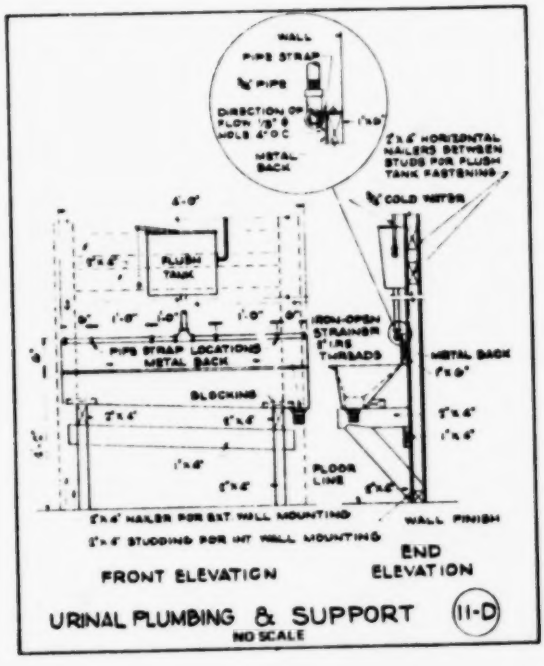

FIGURE 27

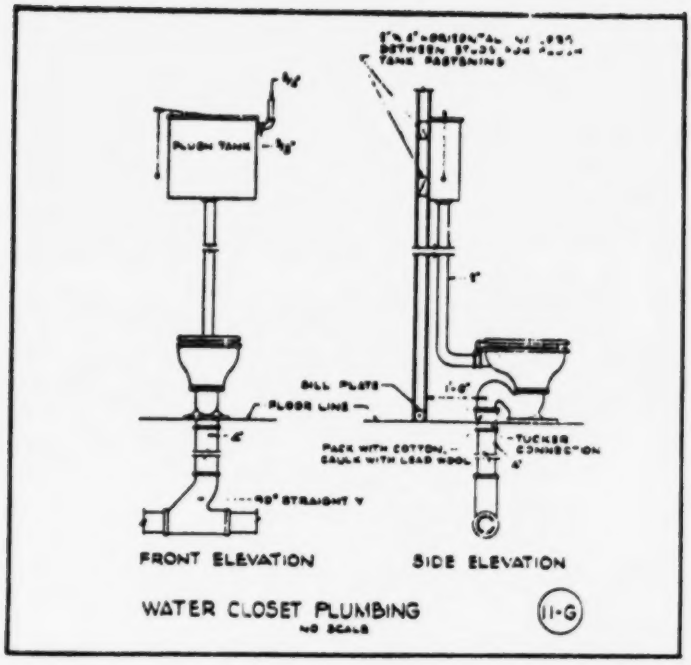

FIGURE 28

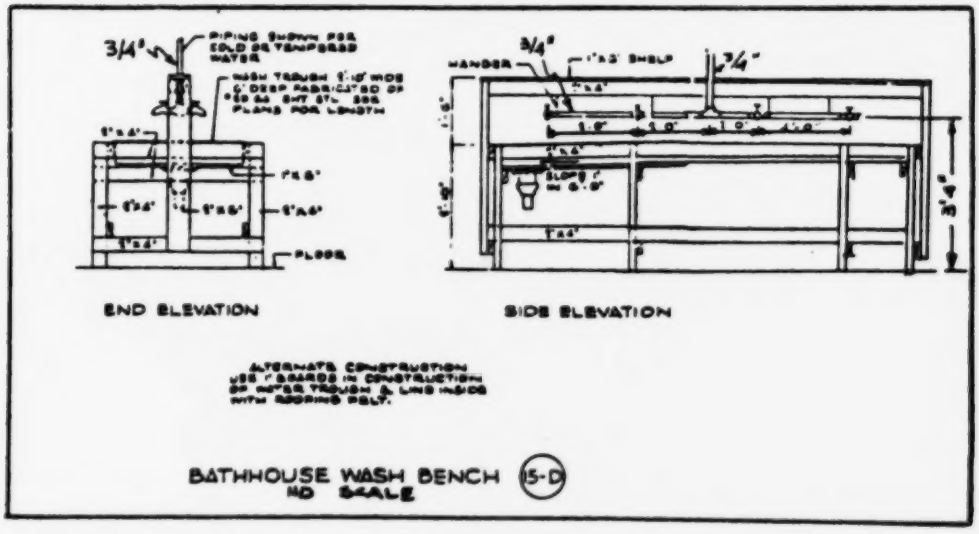

FIGURE 29

b. To find the TOTAL NUMBER OF TEES needed by SIZE, the method to use is:

(1) Get the NUMBER OF TEES by SIZE that can be found from the blueprint and the reference numbered breakout for each fixture.

(2) Add up all the TEES by SIZE to get the TOTAL amount needed by SIZE for the plumbing water pipe system.

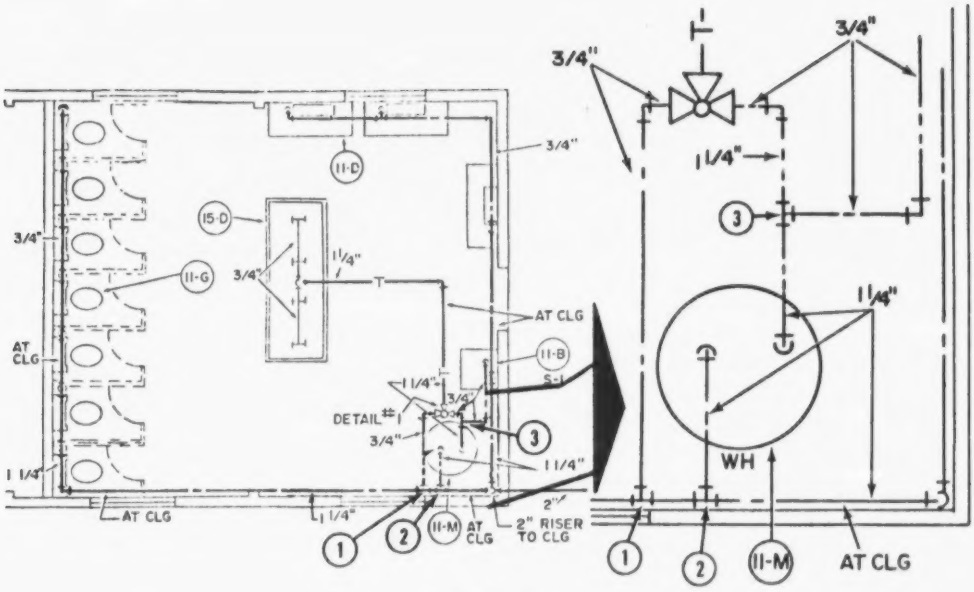

FIGURE 30

c. Starting at the WATER HEATER area, the number of TEES needed by SIZE are shown on the blueprint and the blowup of the WATER HEATER area (Figure 30):

(1) The number of TEES needed by SIZE are shown by circled numbers (Figure 30). The location and TEE SIZES are:

① 1¼"x3/4" TEE

② 1¼" TEE

③ 1¼"x3/4" TEE

(2) Now ADD UP all the TEES by SIZE.

SIZE	NUMBER
1¼"x3/4" TEE	2
1¼" TEE	1

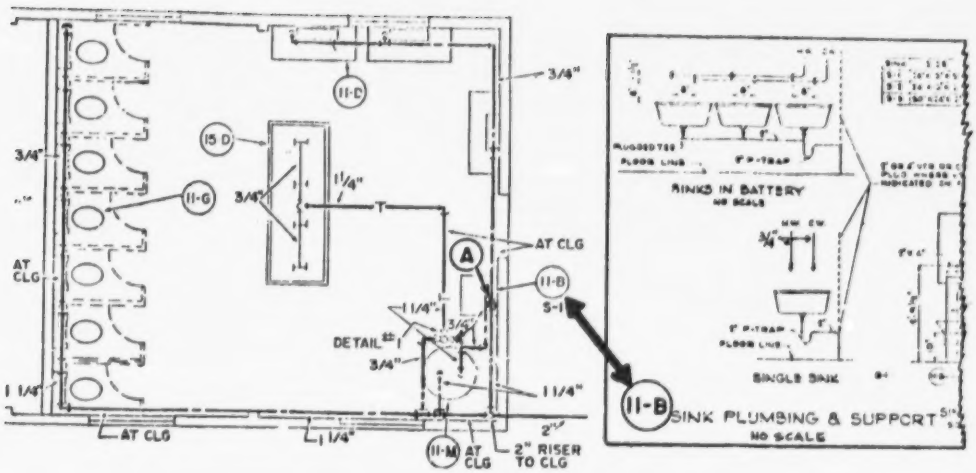

FIGURE 31

d. The blueprint shows a TEE, OUTLET DOWN, at point (A) for cold water service to the single sink (Figure 31). The water pipe size to and from the TEE at point (A) is 1¼". The cold water (CW) pipe size going down to the single sink is 3/4" (Breakout (11-B)). Therefore, the TEE needed by SIZE is ONE 1¼"x3/4".

SIZE	NUMBER
1¼"x3/4"	1

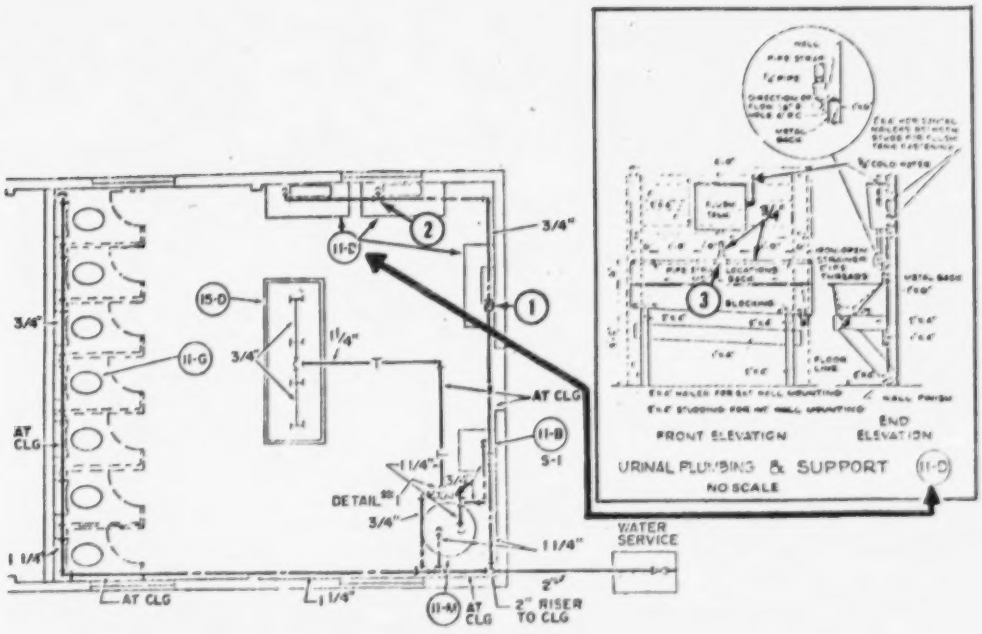

FIGURE 32

e. To find the NUMBER of TEES needed by SIZE for COMPLETE cold water service to each of the URINALS, you have to find the size of the pipe to and from the TEES. Starting at point (1) (Figure 32) and using the URINAL BREAKOUT (11-D), you can find the NUMBER of TEES needed by SIZE. The circled numbers pinpoint the TEES that are needed by SIZE (Figure 32).

(1) (1) is a TEE, OUTLET DOWN whose size is 1¼"x3/4"x3/4"

(2) (2) is a TEE whose size is 3/4"

(3) (3) shows a TEE whose size is 3/4" for only one urinal. Since the blueprint shows THREE URINALS, the TEE at point (3) is needed for each of the THREE URINALS.

(4) The TOTAL TEES needed by SIZE are:

SIZE	NUMBER
1¼"x3/4"x3/4" TEES	1
3/4" TEES	4

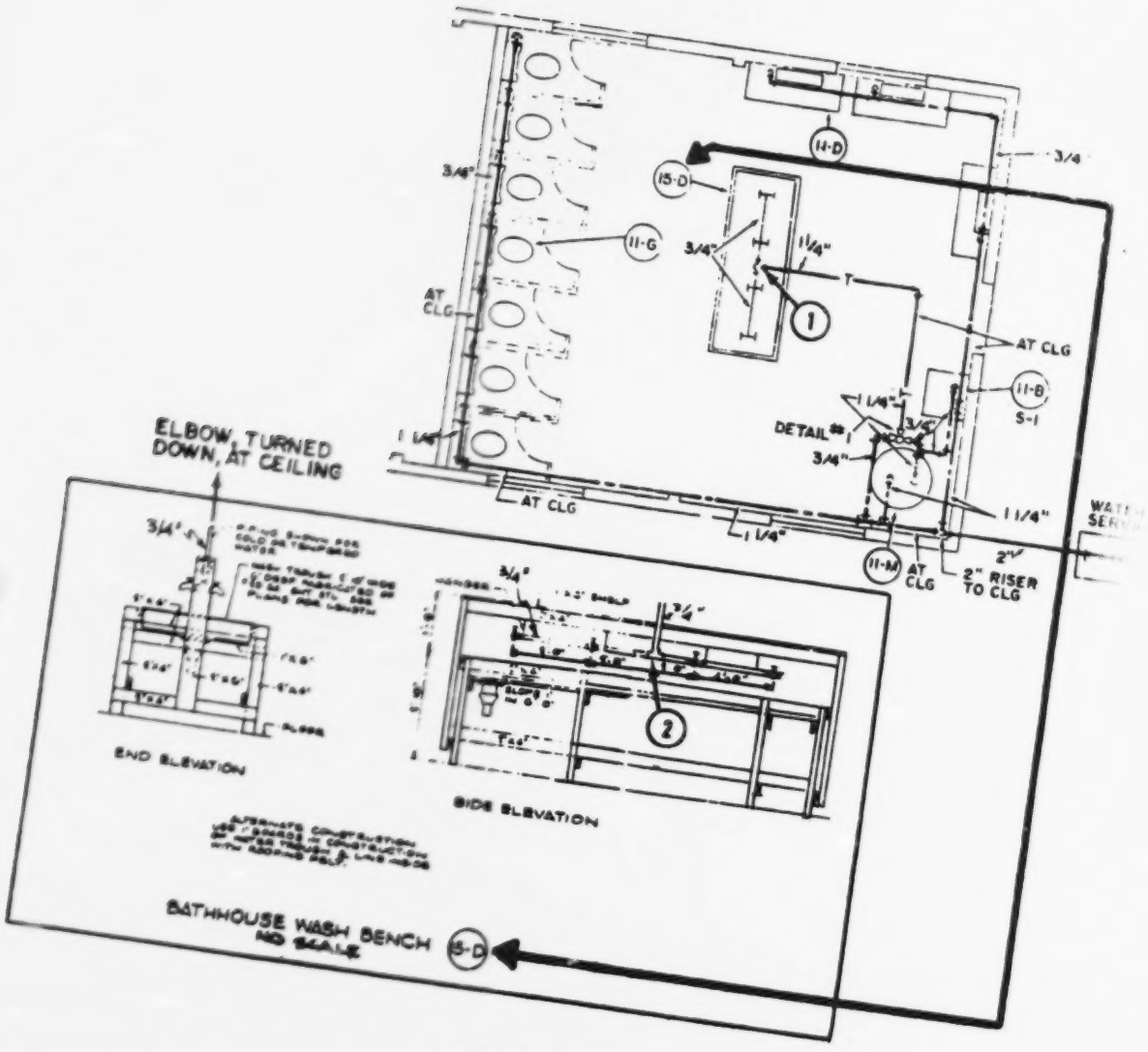

FIGURE 33

f. To find the NUMBER of TEES by SIZE and TYPE for water service to the Bathhouse Wash Bench, you have to start at point (1) (Figure 33) and find the size of the pipe to point (2) (Breakout (15-D)). The breakout (15-D) shows the pipe size to be 3/4". The blueprint shows the pipes at the washbench to be 3/4"

(1) So the TEE needed by SIZE at Point (2) is 3/4".

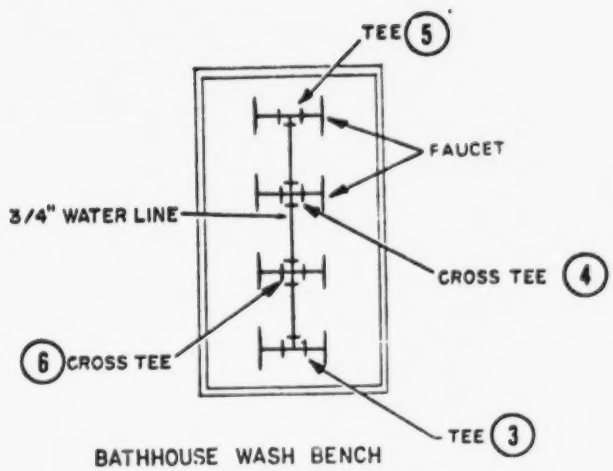

FIGURE 34

(2) All the other TEES needed by SIZE and TYPE are shown in Figure 34 to give you a better understanding of their location on the wash bench and the TYPE used. The circled numbers pinpoint the other TEES needed by SIZE and TYPE at the wash bench (Figure 34). Since the pipe size is 3/4", the TEE SIZES needed are:

③	3/4" TEE	⑤	3/4" TEE
④	3/4" CROSS TEE	⑥	3/4" CROSS TEE

(3) The TOTAL NUMBER of TEES needed by SIZE and TYPE for water service to the wash bench are:

SIZE	NUMBER	LOCATION
3/4" TEES	3	②, ③, ⑤
3/4" CROSS TEES	2	④ ⑥

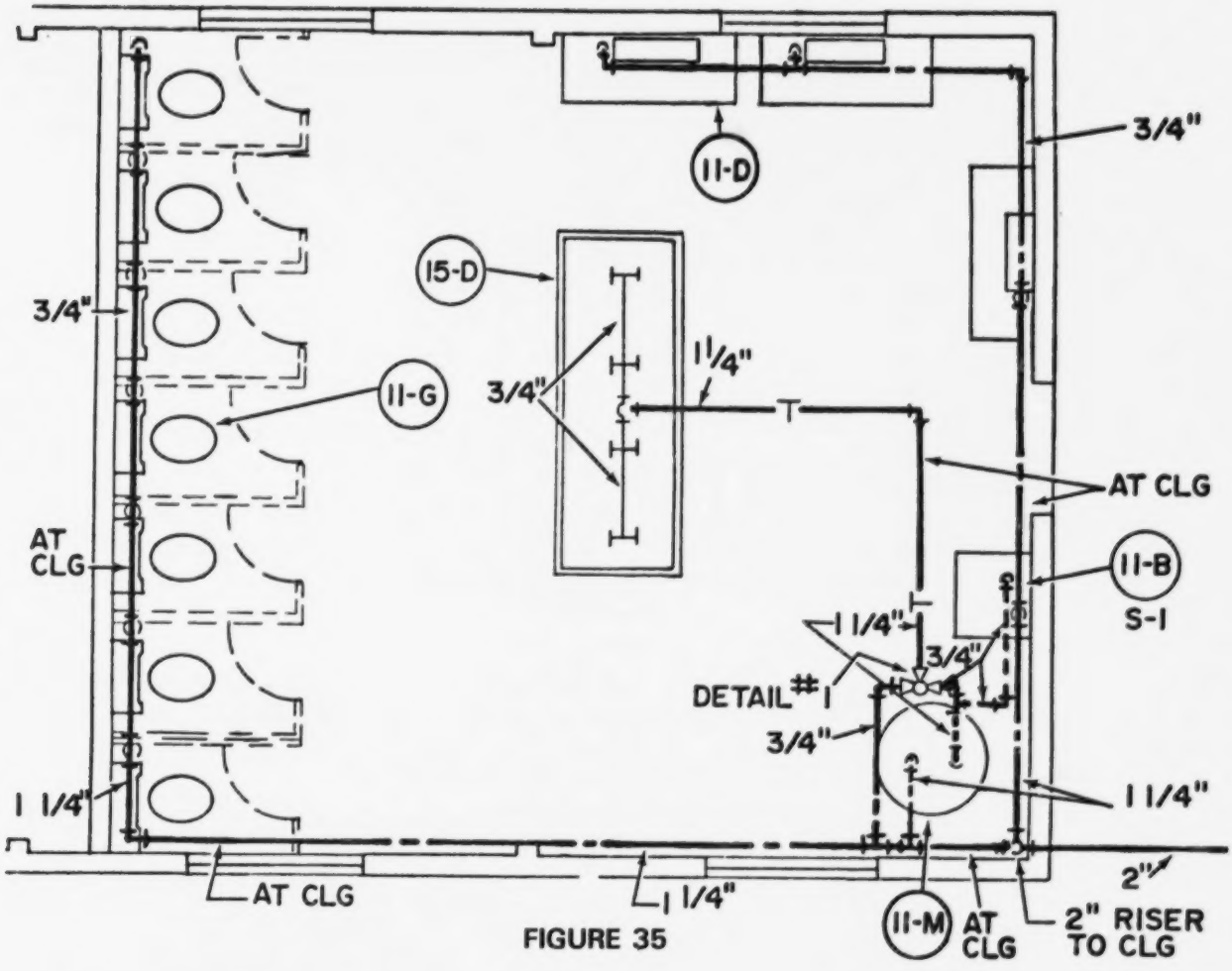

FIGURE 35

g. The NUMBER of TEES TURNED DOWN, needed by SIZE for cold water service to the water closet flush tanks are shown in the numbered circle (Figure 35). To get the SIZE of the TEES, you need the reference numbered breakout (11-G) for a water closet to get the size of the pipe coming down to the flush tank. Turn to the next page for a complete look at the blueprint along with a water closet breakout (11-G) .

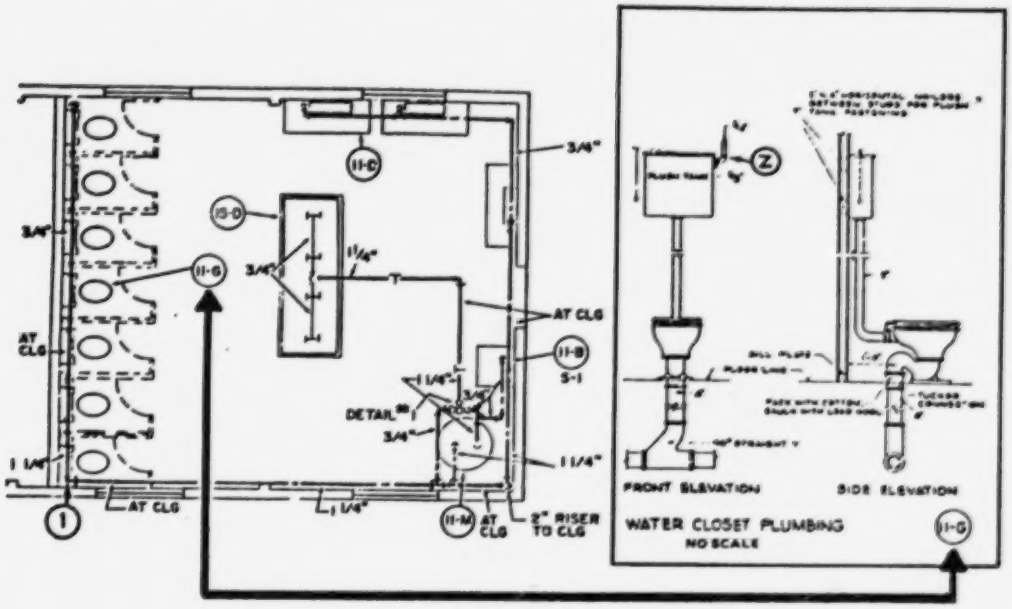

FIGURE 36

(1) The SIZE of the cold water pipe from each of the SIX TEES down to the water closet flush tanks is 3/4" (Figure 36) as shown on the breakout (11-G) .

(2) Starting at point (A) , the SIZE of each TEE needed is:

(1)	1¼"x3/4" TEE	(4)	1¼"x3/4"x3/4" TEE (THE PIPE SIZE CHANGES FROM 1¼" to 3/4" AT THIS POINT)
(2)	1¼" TEE	(5)	3/4" TEE
(3)	1¼"x3/4" TEE	(6)	3/4" TEE

(3) The TOTAL TEES needed by SIZE for water service to the water closet flush tanks are:

SIZE	NUMBER	LOCATION
1¼"x3/4" TEES	3	(1) , (2) , (3)
1¼"x3/4"x3/4" TEES	1	(4)
3/4" TEES	2	(5) , (6)

h. To get the TOTAL TEES needed by SIZE for the plumbing water systems, make a list of them, then add them up by SIZE.

	SIZE	NUMBER
(1) TEES AT THE WATER HEATER AREA	1¼"x3/4"	2
	1¼"	1
(2) TEES AT THE SINGLE SINK	1¼"x3/4"	1
(3) TEES AT THE URINALS	1¼"x3/4"x3/4"	1
	3/4"	4
(4) TEES AT THE WASH BENCH	3/4" TEES	3
	3/4" CROSS TEES	2
(5) TEES AT THE WATER CLOSETS	1¼"x3/4"	3
	1¼"x3/4"x3/4"	1
	3/4"	2

(6) The TOTAL TEES NEEDED BY SIZE ARE:

SIZE	NUMBER
1¼"x3/4"	6
1¼"	1
1¼"x3/4"x3/4"	2
3/4" TEES	9
3/4" CROSS TEES	2

i. Now turn to the next page and take the self evaluation test. If you have any doubt about how to get the number of TEES needed by SIZE, you should go back and review the information and then turn to the next page and take the self-evaluation test.

PRACTICE EXERCISE

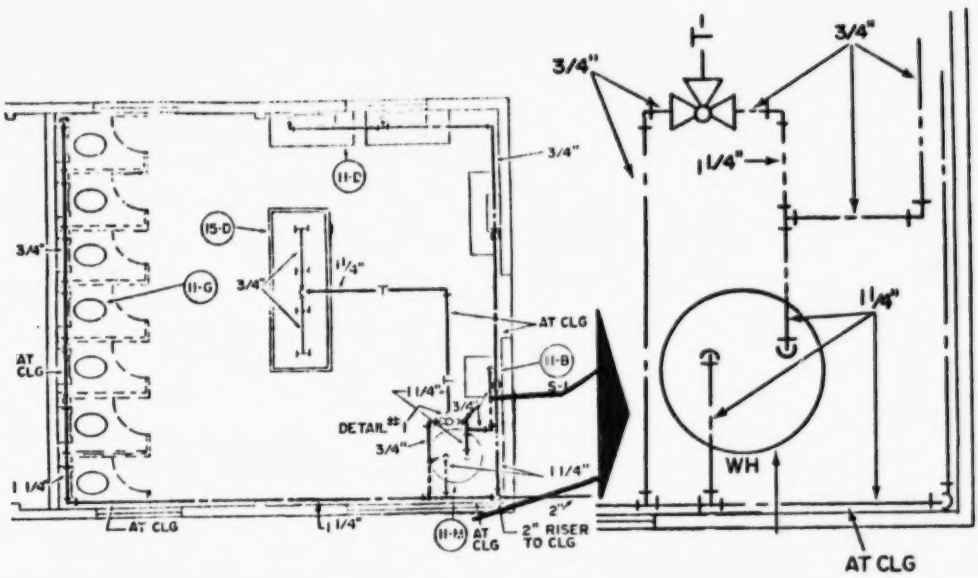

FIGURE 37

1. How many TEES are needed by SIZE for the WATER HEATER AREA? (Figure 37).

SIZE	NUMBER

PRACTICE EXERCISE

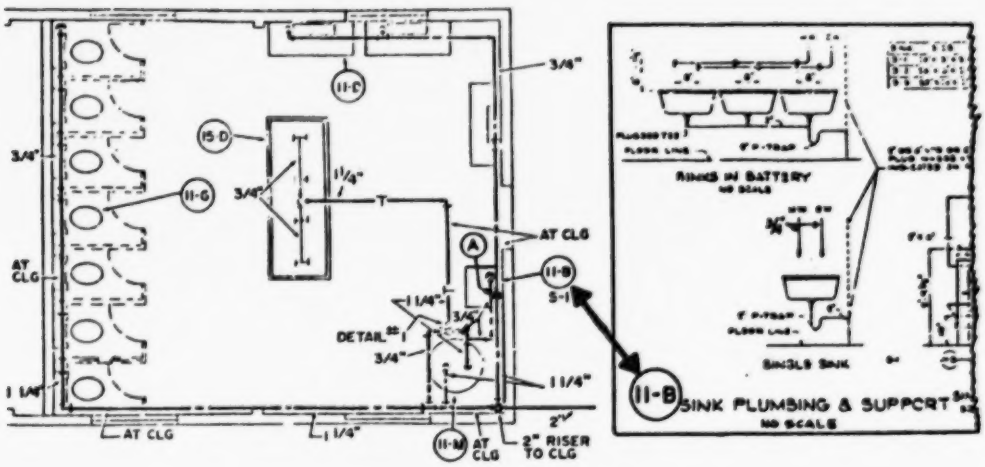

FIGURE 38

2. How many TEES are needed by SIZE for cold water service to the SINGLE SINK from point (A) ? (Figure 38)

SIZE	NUMBER

PRACTICE EXERCISE

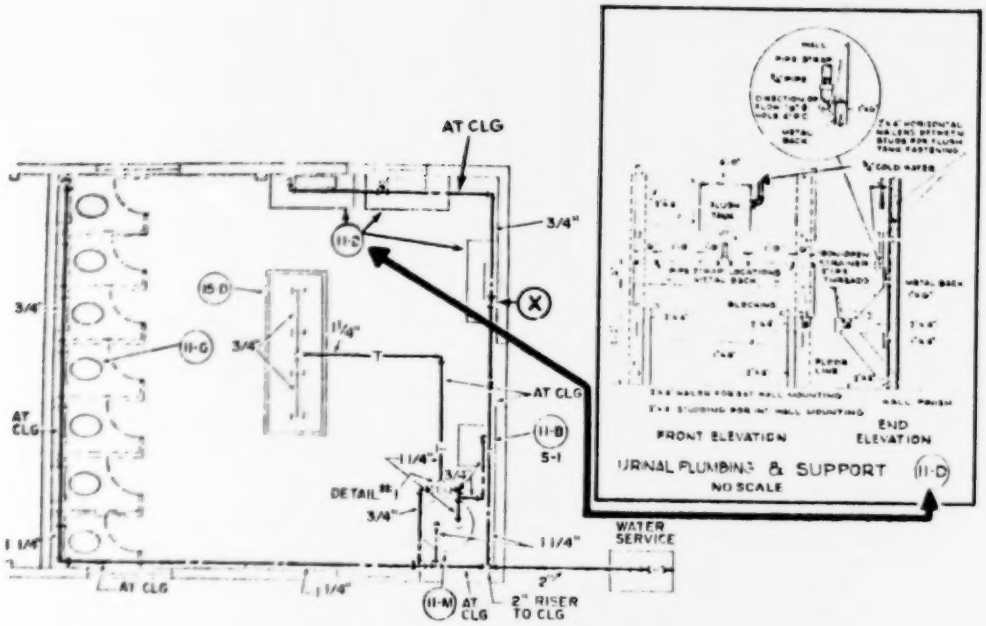

FIGURE 39

3. How many TEES are needed by SIZE for cold water service to ALL URINALS from point (X) ? (Figure 39)

SIZE	NUMBER

PRACTICE EXERCISE

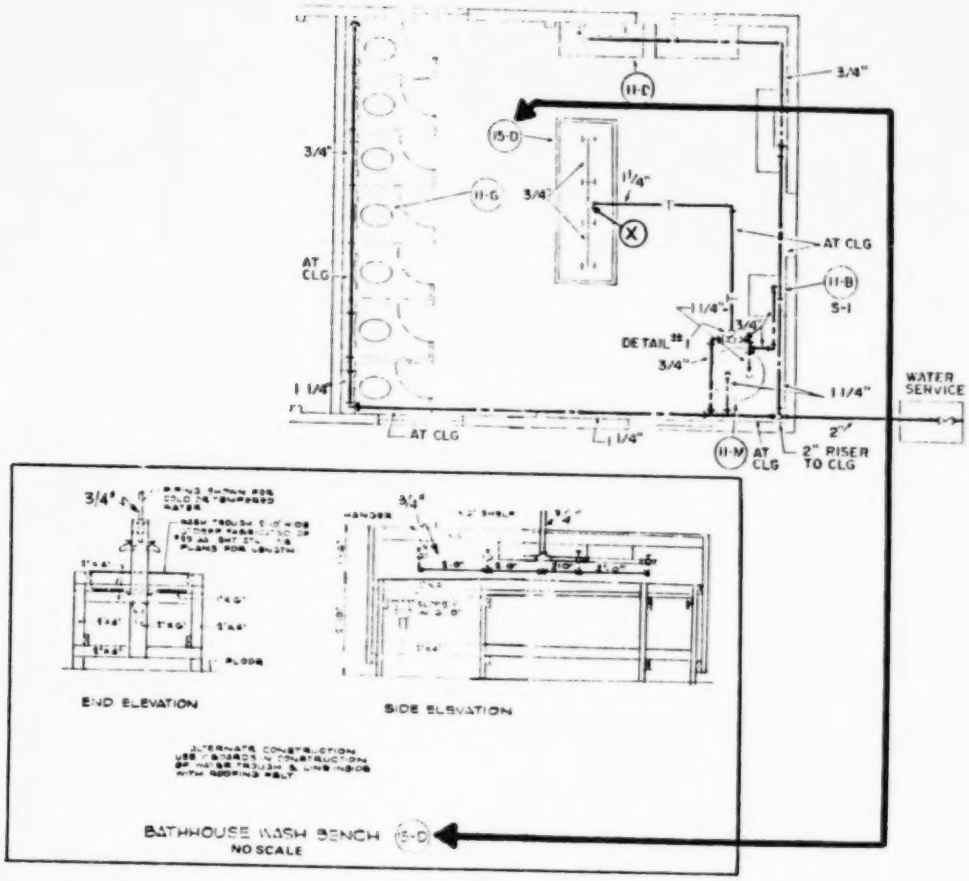

FIGURE 40

4. How many TEES and CROSS TEES are needed by SIZE for COMPLETE water service at the Bathhouse Wash Bench from point (X) ? (Figure 40)

SIZE	NUMBER

PRACTICE EXERCISE

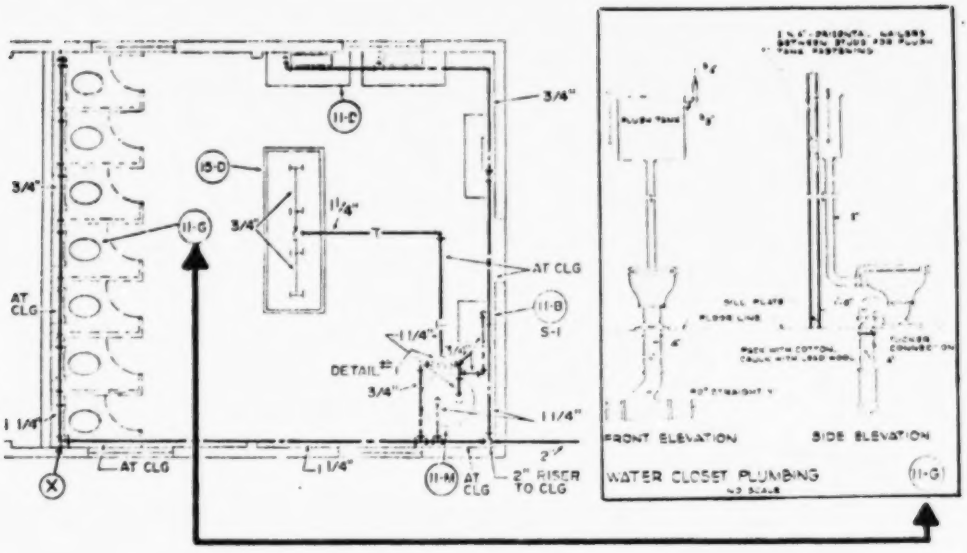

FIGURE 41

5. How many TEES are needed by SIZE for cold water SERVICE to ALL the water closet flush tanks from point Ⓧ ? (Figure 41)

SIZE	NUMBER

CHECK ALL YOUR ANSWERS WITH THE SOLUTIONS ON THE FOLLOWING PAGES

SOLUTION

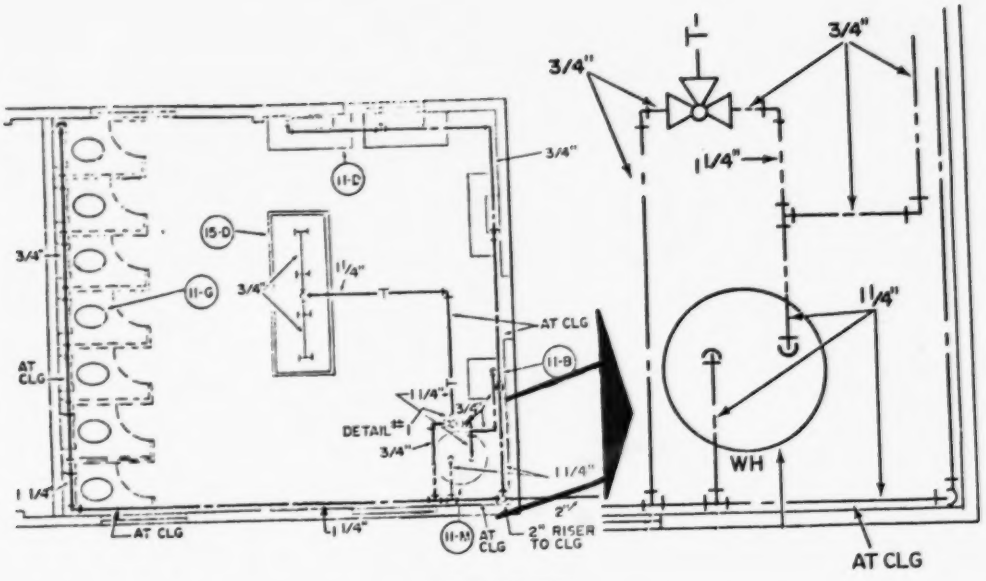

FIGURE 37

1. How many TEES are needed by SIZE for the WATER HEATER AREA? (Figure 37)

SIZE	NUMBER
1¼"x3/4" TEE	2
1¼" TEE	1

LOCATION OF TEES BY SIZE:

① 1¼"x3/4"
② 1¼"
③ 1¼"x3/4"

SOLUTION

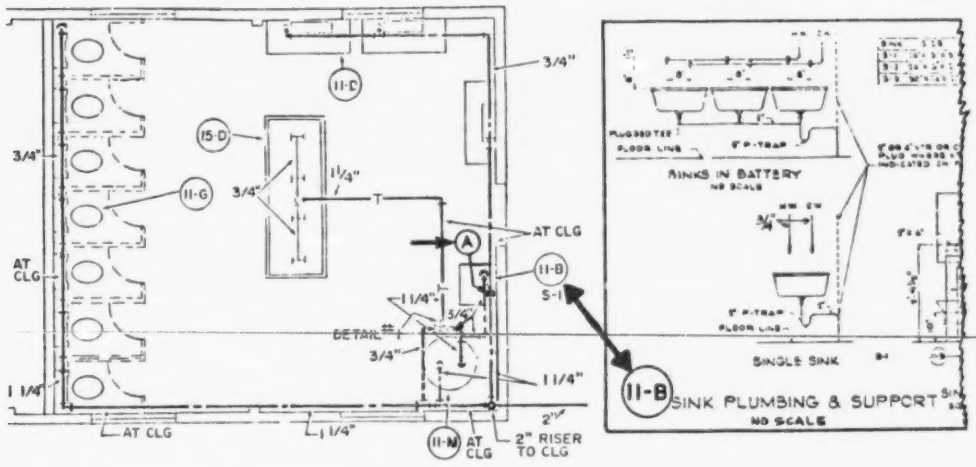

FIGURE 38

2. How many TEES are needed by SIZE for cold water service to the SINGLE SINK from point (A) ? (Figure 38)

SIZE	NUMBER
1¼"x3/4"	1

LOCATION OF TEE BY SIZE

(A) 1¼"x3/4"

SOLUTION

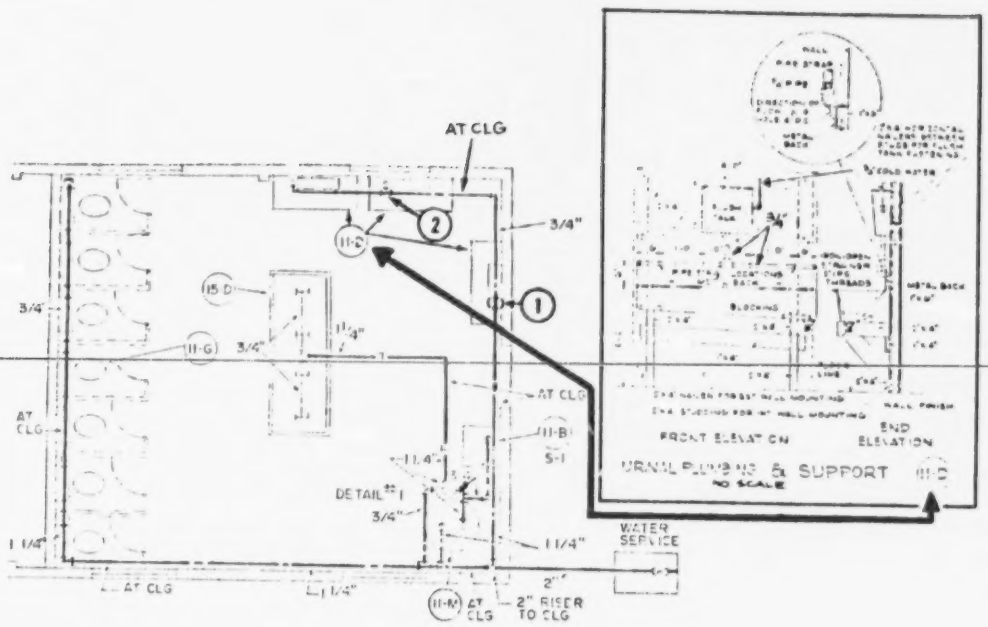

FIGURE 39

3. How many TEES are needed by SIZE for cold water service to ALL URINALS from point Ⓧ ? (Figure 39)

SIZE	NUMBER
1¼x3/4"x3/4" TEES	1
3/4" TEES	4

LOCATION OF TEES BY SIZE

① 1¼"x3/4"x3/4"

② 3/4"

③ 3/4" ONE FOR EACH OF THE THREE URINALS

SOLUTION

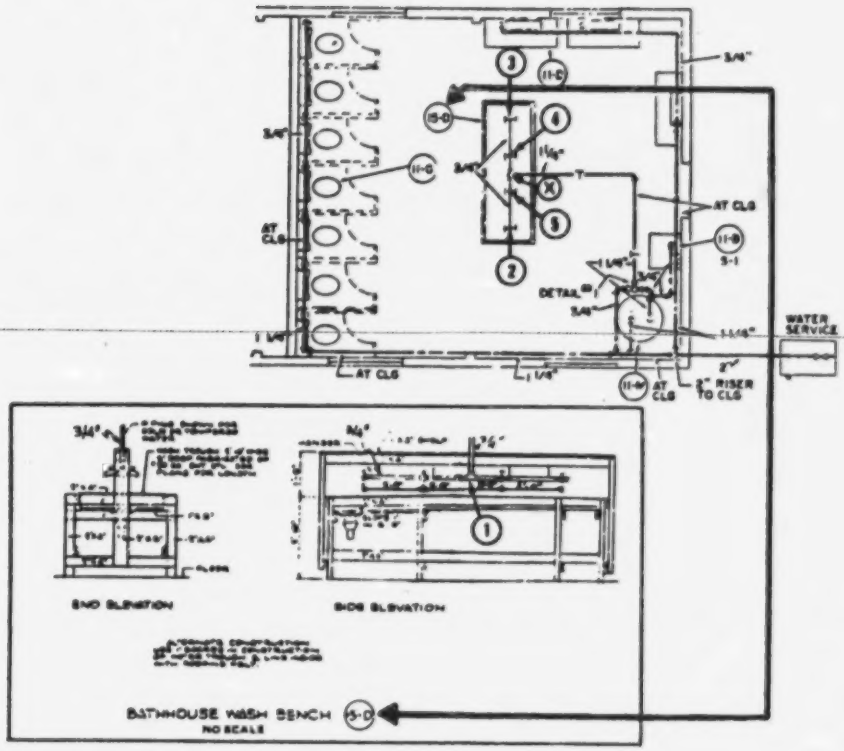

FIGURE 40

4. How many TEES and CROSS TEES are needed by SIZE for COMPLETE water service at the Bathhouse Wash Bench from point (X) ? (Figure 40)

SIZE	NUMBER
3/4" TEES	3
3/4" CROSS TEES	2

LOCATION OF TEES BY SIZE

(1) 3/4" (3) 3/4" (5) 3/4" CROSS TEE

(2) 3/4" (4) 3/4" CROSS TEE

SOLUTION

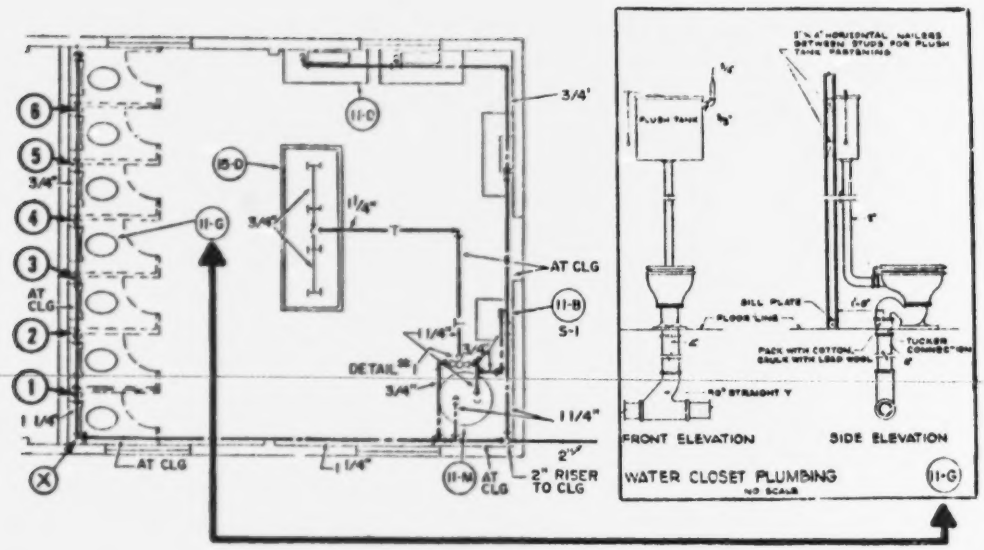

FIGURE 41

5. How many TEES are needed by SIZE for cold water service to ALL the water closet flush tanks from point Ⓧ ? (Figure 41)

SIZE	NUMBER
1¼"x3/4" TEES	3
1¼"x3/4"x3/4" TEES	1
3/4" TEES	2

LOCATION OF TEES BY SIZE

①	1¼"x3/4"	④	1¼"x3/4"x3/4"
②	1¼"x3/4"	⑤	3/4"
③	1¼"x3/4"	⑥	3/4"

3. DETERMINE THE NUMBER OF FAUCETS BY TYPE AND SIZE:

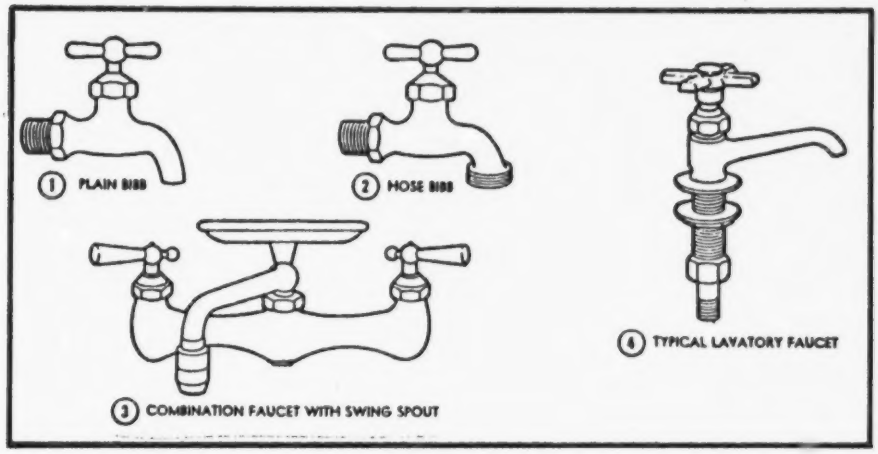

FIGURE 42

a. Faucets are fittings that control the flow of water at the end of a hot and/or cold water supply line. Typical faucets used are shown in Figure 42. The location of the water supply lines on the blueprint and the location of the water supply lines on the fixture breakouts can determine the types and sizes of faucets to be used. This is true for any sink or bathhouse wash bench. For this lesson, you will use the faucet identified as (1) in Figure 42.

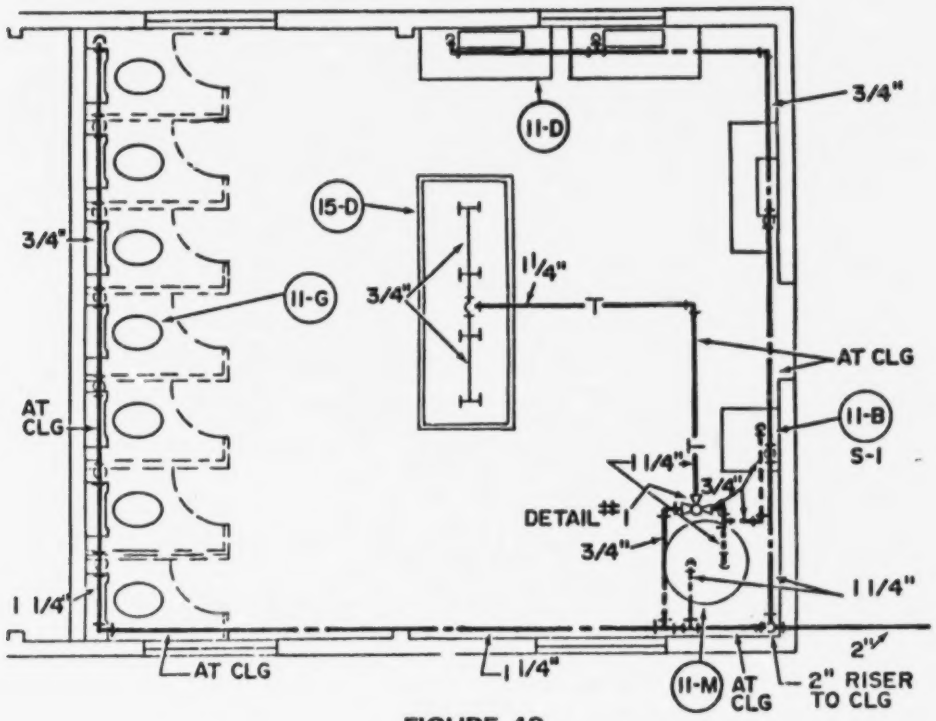

FIGURE 43

b. To find the NUMBER of FAUCETS needed by SIZE, you need a blueprint (Figure 43) and the fixture reference numbered breakout for (11-B) and (15-D) shown on the next page (Figures 44 and 45).

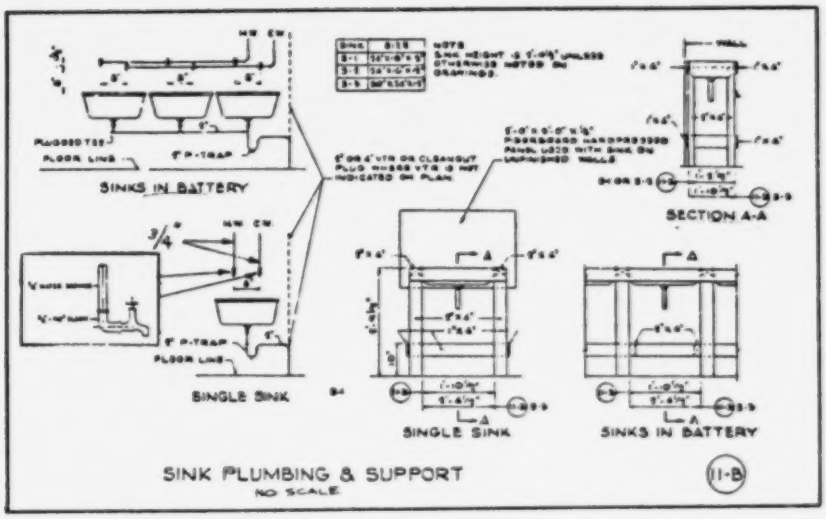

FIGURE 44

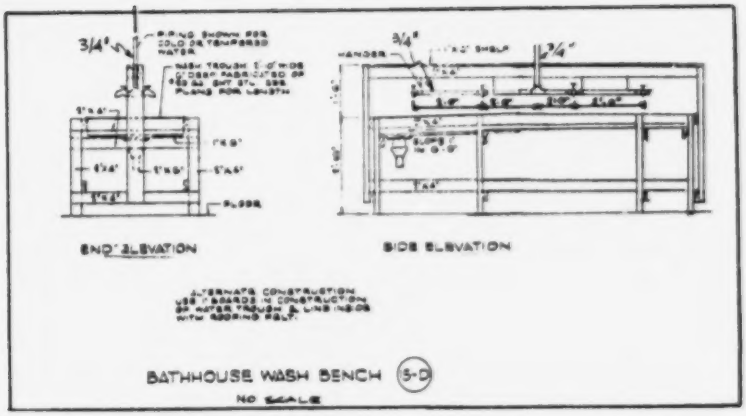

FIGURE 45

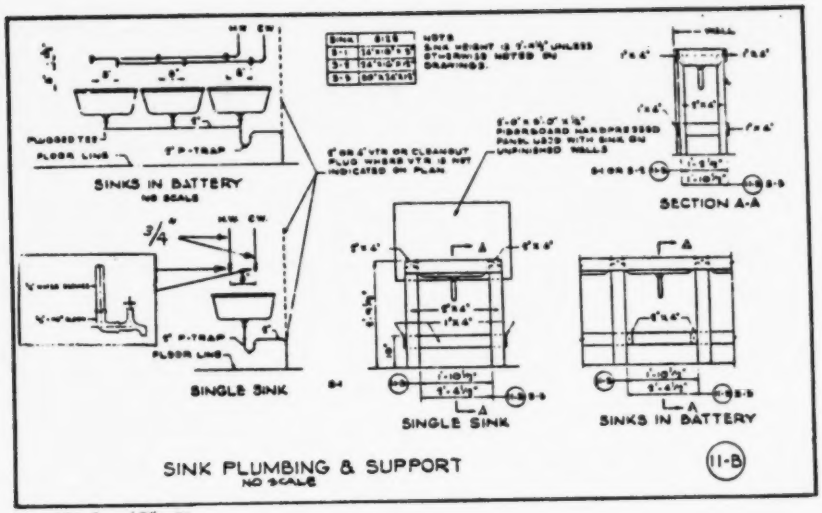

FIGURE 46

(1) The SINK BREAKOUT (11-B) (Figure 46) shows the size of the HOT WATER (HW) and COLD WATER (CW) pipe for a single sink to be 3/4". It also shows that TWO FAUCETS are needed: ONE FAUCET for the hot water line and ONE FAUCET for the cold water line. So the NUMBER of FAUCETS needed by SIZE is TWO 3/4" FAUCETS.

SIZE	NUMBER
3/4" FAUCETS (PLAIN BIR)	2

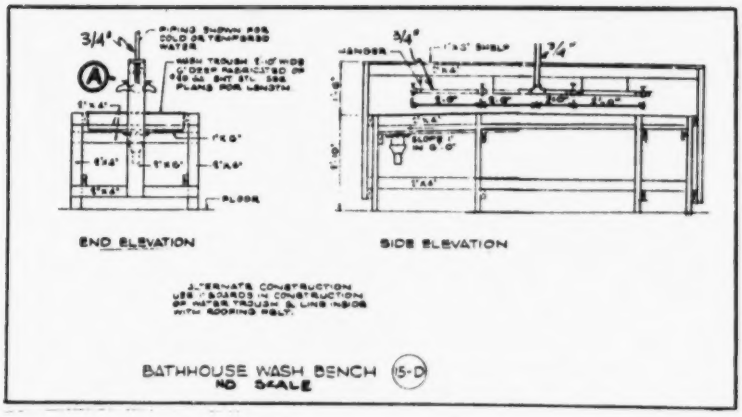

FIGURE 47

(2) The WASH BENCH BREAKOUT (15-D) (Figure 47) shows the size of the water pipe as 3/4" to the FAUCETS. The FAUCETS are located on each side of the wash bench as shown at point (A) (Figure 47) and on the blueprint (Figure 43). So the wash bench needs EIGHT FAUCETS 3/4" in SIZE.

SIZE	NUMBER
3/4" FAUCETS (PLAIN BIB)	8

(3) The TOTAL NUMBER of FAUCETS needed by SIZE for the plumbing water system is 10 FAUCETS 3/4" in SIZE.

SIZE	NUMBER	LOCATION
3/4" FAUCETS	2	SINK
3/4" FAUCETS	8	WASH BENCH
TOTAL	10	

c. Now turn to the next page and work on the practice exercise. If you have any doubt about how to get the number of faucets needed by size, you should go back and review the information and then turn to the next page and work on the practice questions.

PRACTICE EXERCISE

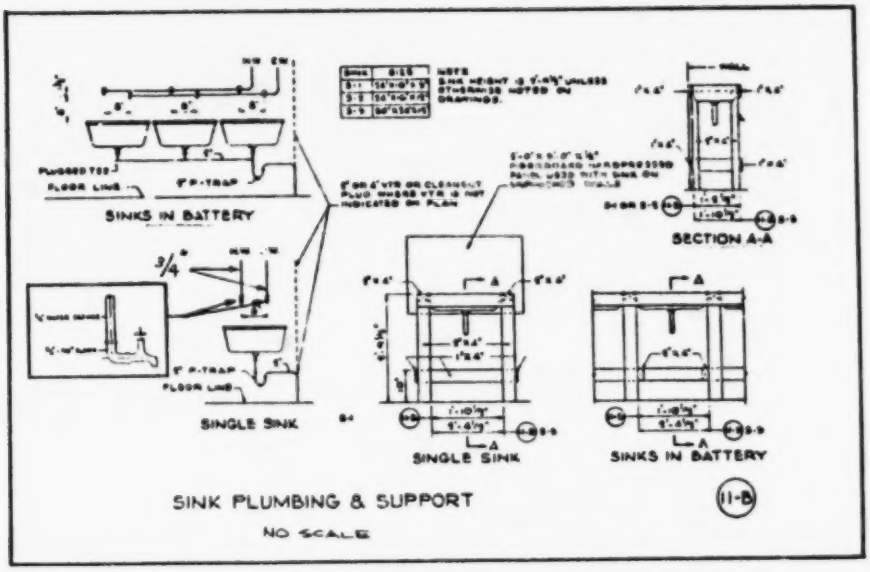

FIGURE 48

1. How many FAUCETS are needed by SIZE to COMPLETE water service to the SINGLE SINK? (Figure 48)

SIZE	NUMBER

PRACTICE EXERCISE

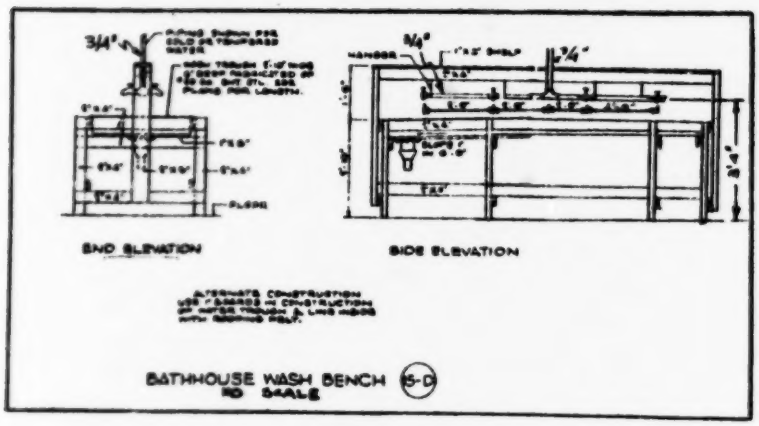

FIGURE 49

2. How many FAUCETS are needed by SIZE for COMPLETE water service to the BATHHOUSE WASH BENCH? (Figure 49)

SIZE	NUMBER

SOLUTION

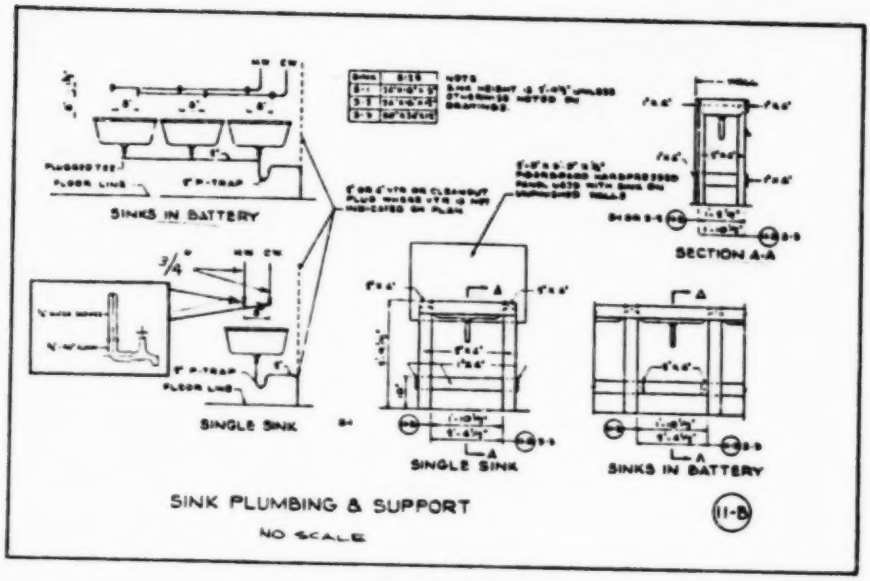

FIGURE 48

1. How many FAUCETS are needed by SIZE for complete water service to the SINGLE SINK? (Figure 48)

SIZE	NUMBER
3/4" FAUCETS	2

SOLUTION (CONTINUED)

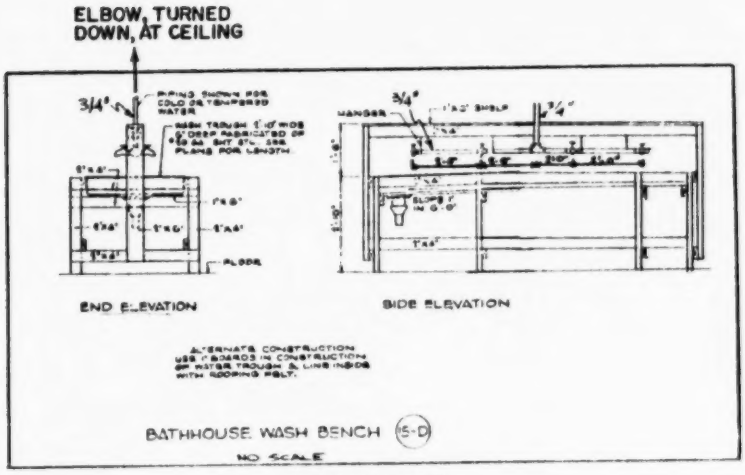

FIGURE 49

2. How many FAUCETS are needed by SIZE for COMPLETE water service to the BATHHOUSE WASH BENCH? (Figure 49)

SIZE	NUMBER
3/4" FAUCETS	8 (4 on each side of wash bench)

SELF TEST

PHASE II

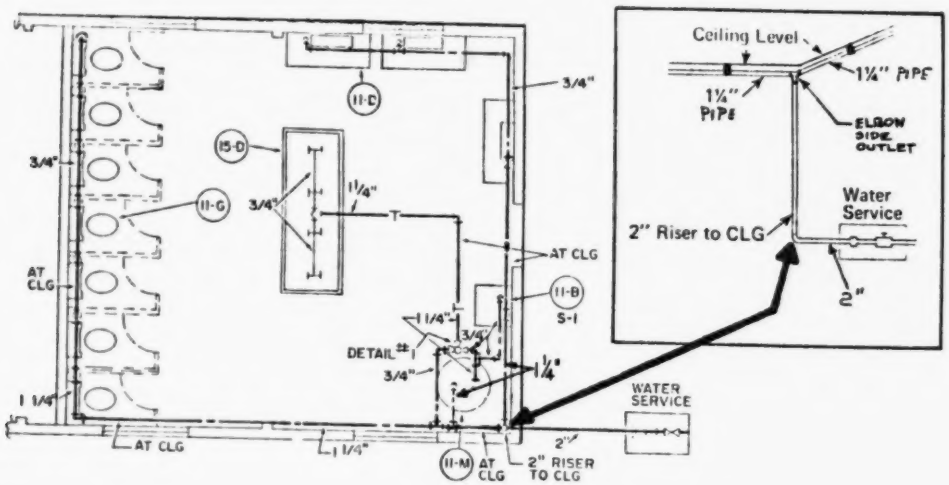

FIGURE 50

1. How many ELBOWS by SIZE are needed to bring cold water supply into the building to the 1¼" pipes at the ceiling level? (Figure 50)

SIZE	NUMBER

SELF TEST (CONTINUED)

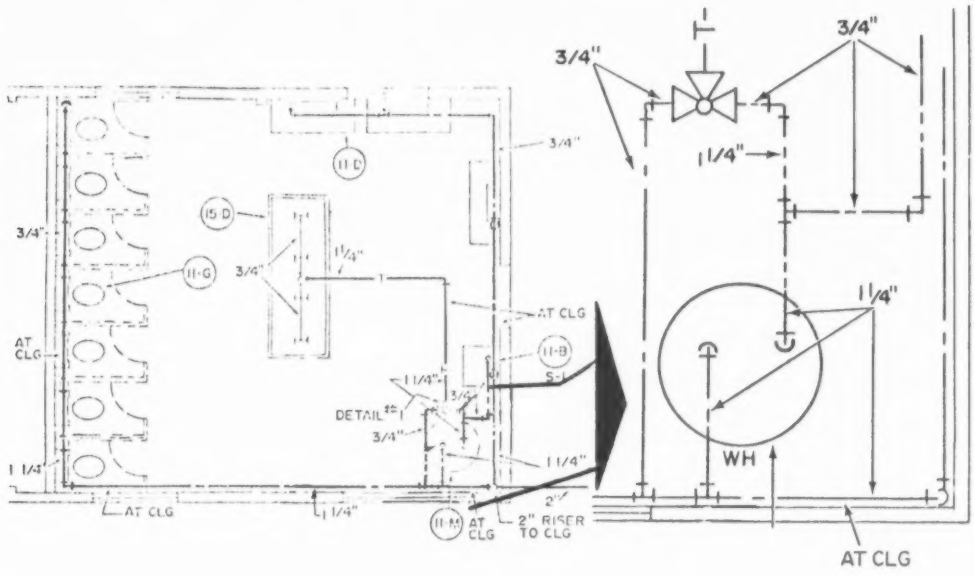

FIGURE 51

2. How many TEES are needed by size for the water heater area? (Figure 51)

SIZE	NUMBER

SELF TEST (CONTINUED)

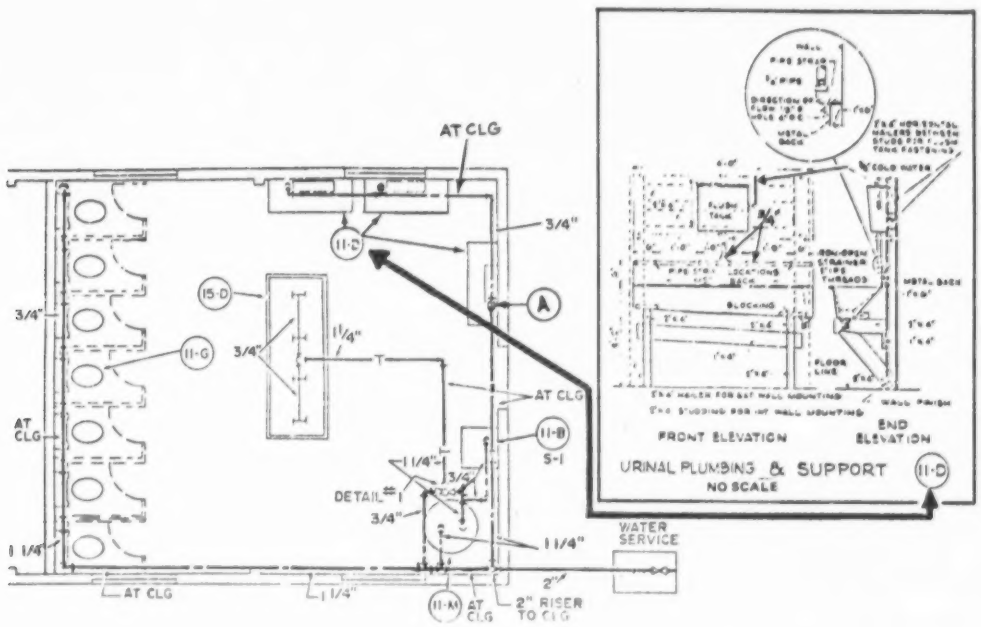

FIGURE 52

3. How many ELBOWS by SIZE are needed from point Ⓐ to all the urinal flush tanks? (Figure 52)

SIZE NUMBER

4. How many TEES by SIZE are needed from point Ⓐ (include point Ⓐ) to all the urinal flush tanks? (Figure 52)

SIZE NUMBER

SELF TEST (CONTINUED)

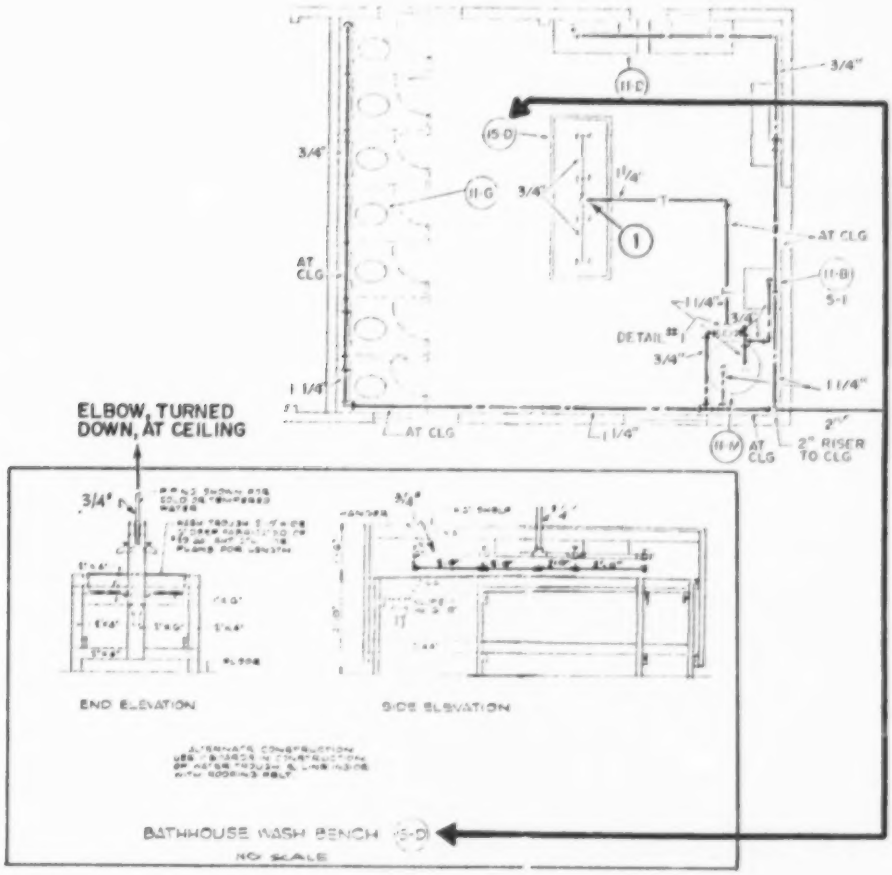

FIGURE 53

5. How many TEES are needed by TYPE and SIZE for complete water service at the BATHHOUSE WASH BENCH from point (1) ? (Figure 53)

SIZE _____ NUMBER _____

6. How many FAUCETS are needed by SIZE at the BATHHOUSE WASH BENCH? (Figure 53)

SIZE _____ NUMBER _____

CHECK YOUR ANSWERS WITH THE SOLUTIONS ON THE FOLLOWING PAGES

SELF TEST

SOLUTION
PHASE II

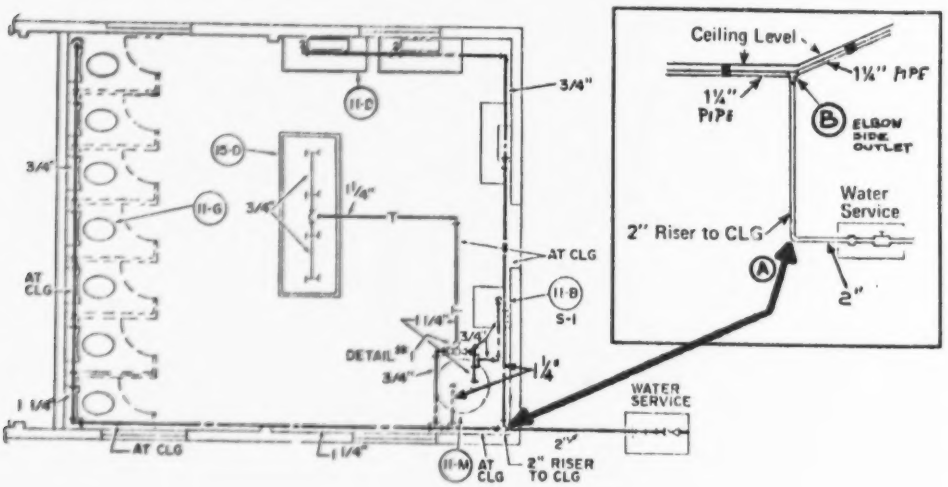

FIGURE 50

1. How many ELBOWS by SIZE are needed to bring cold water supply into the building to the 1¼" pipes at the ceiling level? (Figure 50)

SIZE	NUMBER	LOCATION
2" ELBOWS	1	Ⓐ
2"x1¼"x2¼" ELBOW, SIDE OUTLET	1	Ⓑ

SELF TEST SOLUTION

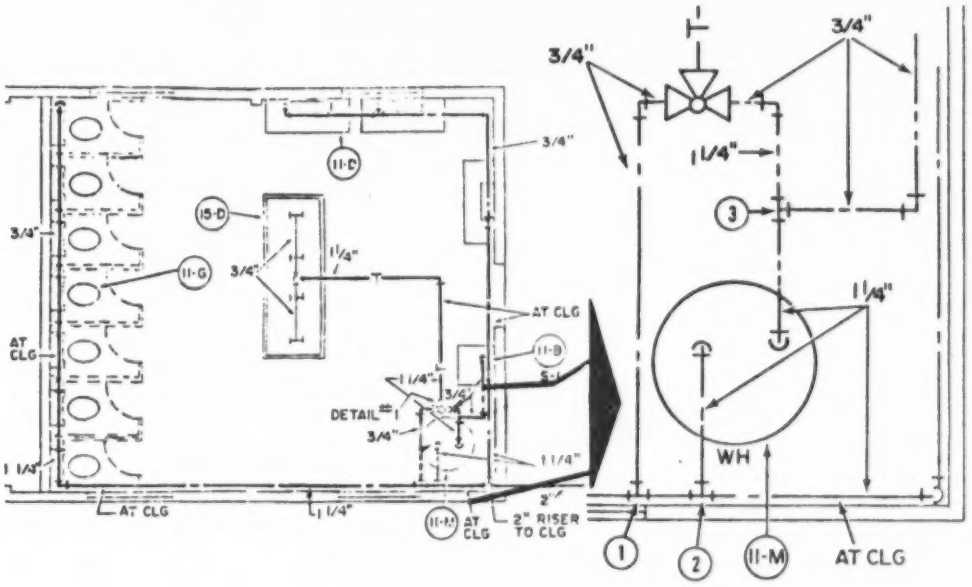

FIGURE 51

2. How many TEES are needed by SIZE for the water heater area? (Figure 51)

SIZE	NUMBER	LOCATION
1¼"x3/4" TEES	2	① and ③
1¼" TEES	1	②

SELF TEST SOLUTION

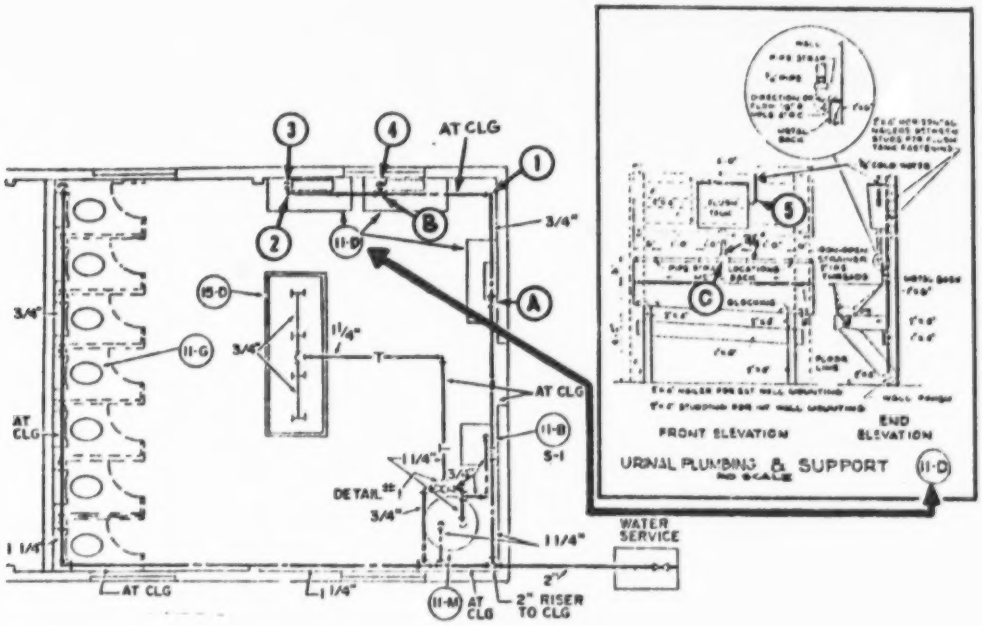

FIGURE 52

3. How many ELBOWS by SIZE are needed from point Ⓐ to all the urinal flush tanks? (Figure 52)

SIZE	NUMBER	LOCATION
3/4" ELBOWS	7	① ② ③ ④ and ⑤

4. How many TEES by SIZE are needed from point Ⓐ (include point Ⓐ) for complete cold water service to all urinals? (Figure 52)

SIZE	NUMBER	LOCATION
1¼"x3/4"x3/4" TEES	1	Ⓐ
3/4" TEES	4	Ⓑ and Ⓒ

SELF TEST SOLUTION

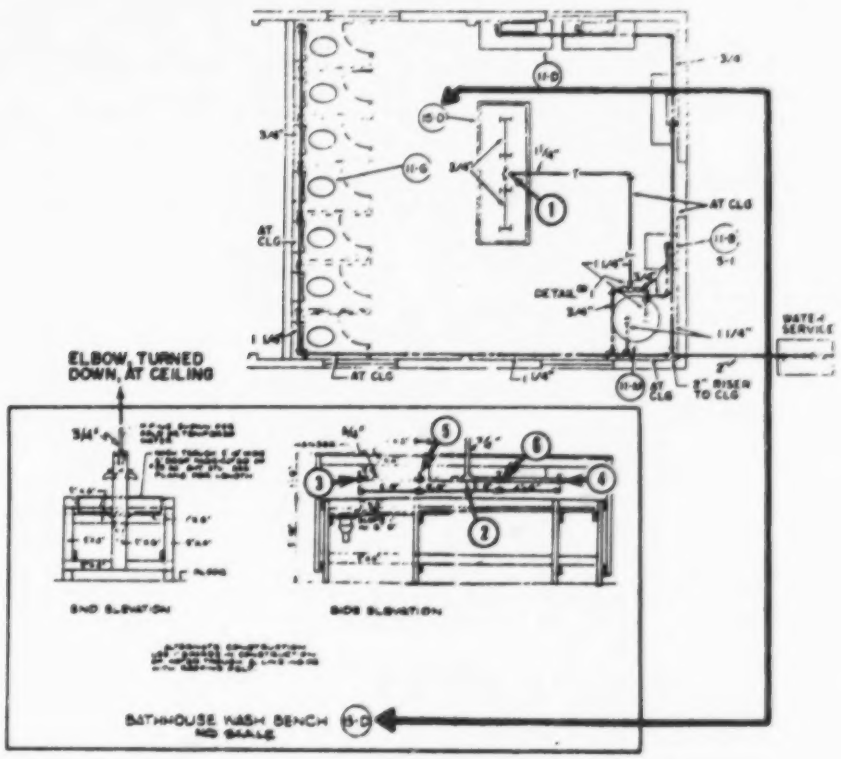

FIGURE 53

5. How many TEES are needed by TYPE and SIZE for complete water service at the BATHHOUSE WASH BENCH? (Figure 53)

SIZE	NUMBER	LOCATION
3/4" TEES	3	②, ③, and ④
3/4" CROSS TEES	2	⑤ and ⑥

6. How many FAUCETS are needed by SIZE at the BATHHOUSE WASH BENCH? (Figure 53)

SIZE	NUMBER
3/4" FAUCETS	8 (4 on each side of washbench)

3. SUMMATION

a. You have just completed LESSON II of PREPARE A PLUMBING TAKEOFF LIST.

b. You now know how to TAKEOFF the type of pipe fitting such as elbows, tees, and faucets off a blueprint by size. If you had any trouble with any areas of the SELF-TEST, you should thoroughly review the material and make sure that the material presented is clearly understood.

c. After you are confident that you understand this phase, you can now ask your administrator to give you the criterion (POST) test for LESSON II.

d. After successful completion of the criterion test, you will be ready to begin LESSON III of PREPARE A PLUMBING TAKEOFF LIST. This lesson will cover the materials needed for waste systems.

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PRETEST/POSTTEST ANSWER KEY

Each part of an answer is worth the value shown in the point column. If any part of the questions is missed, the points for that part of the question are subtracted from the total score. The total possible score is 100 points. A passing score is 80 points or more.

	RESPONSE	NUMBER	POINTS
1.	d		
2.	3/4" x 3/8"	7	4
3.	1¼"	1	4
	1¼"	1	4
4.	2"	1	4
	2"x1¼"x1¼"	1	4
	1¼" x 3/4"	2	4
	1¼	4	4
	3/4"	13	4
	3/4" x 3/8"	7	4
5.	c		
6.	1¼" x 3/4"	3	4
	1¼" x 3/4" x 3/4"	1	4
	3/4"	2	4
7.	Tees 3/4"	2	4
	Cross Tees 3/4"	2	4
8.	1¼" x 3/4" x 3/4"	1	4
	3/4"	1	4
9.	1¼" x 3/4"	6	4
	1¼" x 3/4" x 3/4"	2	4
	1¼"	1	4
	3/4"	9	4
	3/4" Cross Tees	2	4
10.	Single Sink	2 – 3/4" Faucets	4
	Wash Bench	8 – 3/4" Faucets	4